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Sport Fishery Abstracts



Vol. 8 No. 2

Abstracts 5635 - 5832

April 1963



DEPARTMENT OF THE INTERIOR

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U. S. FISH AND WILDLIFE SERVICE

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Sport Fishery Abstracts

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Vol. 8, No. 2

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes. The last number of each volume contains a list of publications screened for appropriate material.

Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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Prepared in the Branch of Federal Aid
S. E. Jorgensen, Chief
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5635. Rabb, L., and L. A. McDermott (Ontario Agri. Col., Guelph, Ontario, Canada). 1962. BACTERIOLOGICAL STUDIES OF FRESHWATER FISH. II. FURUNCULOSIS IN ONTARIO FISH IN NATURAL WATERS. Journal of the Fisheries Research Board of Canada, Vol. 19, No. 6, pp. 989-995.

During a period of 29 months, 1044 fish were taken from different sections of 10 streams in southern Ontario and examined for the presence of Aeromonas salmonicida, the bacterium causing furunculosis in fish. Most of the fish examined were brook trout (Salvelinus fontinalis), and carriers of furunculosis were, with one exception, found only in this species of fish. The one exception was a sculpin (Cottus bairdi). Most of the brook trout found to be carriers were taken from the same section of the Beaver River. As yet, no explanation can be given of the high incidence of furunculosis carriers in these waters, nor is their importance known. (Authors)

5636. Molnár, Gyula (Zool. Inst. of the Univ. for Agri. Sci., Gödöllő, Hungary), and István Tölg. 1962. RELATION BETWEEN WATER TEMPERATURE AND GASTRIC DIGESTION OF LARGE-MOUTH BASS (MICROPTERUS SALMOIDES LACÉPÈDE). Journal of the Fisheries Research Board of Canada, Vol. 19, No. 6, pp. 1005-1012.

The rate of gastric digestion of largemouth bass (Micropterus salmoides Lacépède) was measured at 5, 10, 15, 20 and 25° C temperature by the X-ray method of the authors. Bleak (Alburnus alburnus L.) of 8.0-8.5 cm length were force-fed to largemouth bass of 25-27 cm length. There was a more rapid increase in the rate of digestion in the range between 5° and 10° than at higher temperatures. In the stomach of bass the food fish was rolled up into the shape of a spiral during digestion. Because these measurements, unlike *in vitro* experiments, were made under circumstances similar to those existing in nature, they may serve as an indication of rate of digestion in the wild. (Authors)

5637. Scott, W. B. (Royal Ontario Museum, Toronto 5, Ontario, Canada), and Stanford H. Smith. 1962. THE OCCURRENCE OF THE LONGJAW CISCO, LEUCICHTHYS ALPENAE, IN LAKE ERIE. Journal of the Fisheries Research Board of Canada, Vol. 19, No. 6, pp. 1013-1023.

The longjaw cisco, Leucichthys alpenae, is shown to be a species new to the Lake Erie fauna. The taxonomic work on Lake Erie ciscoes is reviewed. Thirty-three specimens of L. alpenae taken in 1946, 1947 and 1957 are compared morphometrically with Leucichthys artedi of Lake Erie, the only other cisco species in the lake. L. alpenae has a longer and deeper head, longer maxillary and fewer gill rakers. L. alpenae is more distinct from L. artedi in Lake Huron than in Lake Erie. The rate of growth of L. alpenae in Lake Erie compares favorably with that in Lake Michigan. (Authors)

5638. Brett, J. R. (Fish. Res. Bd. of Canada,

Biol. Sta., Nanaimo, B. C., Canada). 1962. SOME CONSIDERATIONS IN THE STUDY OF RESPIRATORY METABOLISM IN FISH, PARTICULARLY SALMON. Journal of the Fisheries Research Board of Canada, Vol. 19, No. 6, pp. 1025-1038.

A general review of the basis and measurement of respiratory metabolism in fish is presented, with particular reference to sources and magnitudes of influence (error) which various major factors can impose. There is a continuing need for precise measures of metabolism, including quantitative estimates of excretory products, both intrinsically and as a basis for assessing the effect of environmental change. The metabolic cost of locomotion at all levels of performance requires exact definition. Efficiency of performance for fish cannot be determined without a suitable means of relating energy expended to work performed. It is suggested that comparisons be made on the basis of energy required for a propulsion rate of 1 body length per second. (Auth.)

5639. Chapman, D. W. (Fish and Game Mgmt. Dept., Oregon State Univ., Corvallis). 1962. AGGRESSIVE BEHAVIOR IN JUVENILE COHO SALMON AS A CAUSE OF EMIGRATION. Journal of the Fisheries Research Board of Canada, Vol. 19, No. 6, pp. 1047-1080.

Large numbers of coho fry (called nomads) move downstream from shortly after emergence through early fall. These fry are smaller than residual coho. Study of behavior showed coho to be aggressive and territorial or hierarchical. Nomadic coho placed in stream aquaria barren of resident fish tended to remain in the aquaria rather than continuing downstream movement, while nomads added to resident groups of coho were dominated by the resident dominant fish and tended to leave the channels. Hierarchies were organized on the basis of fish size, with larger fry having better growth opportunities. Feeding of coho in excess of requirements did not alter holding capacity of stream aquaria. Aggression observed in natural stream areas was frequent, probably virtually continuous. Nomads transferred to natural stream areas barren of other coho remained there, while nomads added to resident populations tended to move downstream. It was concluded that aggressive behavior is one important factor causing downstream movement of coho fry. (Auth.)

5640. Pycha, Richard L. (U. S. Bur. of Comm. Fish., Ashland, Wisconsin). 1962. THE RELATIVE EFFICIENCY OF NYLON AND COTTON GILL NETS FOR TAKING LAKE TROUT IN LAKE SUPERIOR. Journal of the Fisheries Research Board of Canada, Vol. 19, No. 6, pp. 1085-1094.

The change from cotton to nylon twine for gill nets in 1949-52 resulted in a sharp increase in the efficiency of the most important gear used for taking lake trout in Lake Superior, and consequently, biased estimates for fishing intensity and abundance severely.

From early May to the end of September 1961,

short gangs (2000 or 4000 linear feet) of cotton and nylon nets were fished in parallel sets for lake trout. A total of 343,000 feet of gill netting was lifted. Nylon nets were 2.25 times as efficient as cotton nets for taking legal-sized fish and 2.8 times as efficient for undersized lake trout. The average lengths of legal, undersized, and all lake trout taken in nets of the two materials did not differ greatly. The percentage of the catch which was undersized (less than 1.25 lb, dressed weight) was 20.8 in nylon nets and 17.7 in cotton. The relative efficiency of cotton and nylon nets showed no trend during the season. The efficiency ratio determined in this study was closely similar to that obtained by earlier workers.

Correction of estimates of fishing intensity and abundance for the greater efficiency of the nylon nets used since 1951 has not been attempted. The drastic decline of the lake trout fishery has forced fishermen to make changes in fishing practices in the past few years that cause new bias of an unknown extent to estimates of fishing intensity. (Auth.)

5641. Tanaka, Syoiti (U. S. Bur. of Comm. Fish., Seattle, Washington). 1956. A METHOD OF ANALYZING A POLYMODAL FREQUENCY DISTRIBUTION AND ITS APPLICATION TO THE LENGTH DISTRIBUTION OF THE PORGY, *TAIUS TUMIFRONS* (T. AND S.). Journal of the Fisheries Research Board of Canada, Vol. 19, No. 6, pp. 1143-1159.

By utilizing the fact that normal frequency distributions become parabolas when logarithms are taken, a simple graphical method has been devised for analyzing polymodal distributions into their components. Briefly, the method consists of (a) plotting the observed frequencies on semi-log paper; (b) drawing on transparent paper the parabolas corresponding to a series of values of σ (2 or 3 copies); (c) fitting these parabolas to the observed frequency distribution.

As an example, Rao's data were treated in this way, and the result compared what he obtained by the maximum likelihood method. Though the results do not coincide quite perfectly, there seems to be adequate agreement.

For a second example the length distribution of the porgy was analyzed in this way and compared with what is obtained by (1) using probability graph paper, and (2) fitting parabolas by least squares. The method proposed here is less cumbersome than either of these and it yields good results.

Using the graphical method, the length distributions of porgy were analyzed using the data from September 1950 to December 1952, and the age composition, mean fork length and standard deviation in length were obtained for the separate year-classes. The annual rate of decrease is about 0.7, and the abundance of recent year-classes seems to have declined. Growth in length is linear and amounts to about 4.0 cm per year. The standard deviation in length increases with age, while the coefficient of variation decreases.

The effectiveness of stratification by length

for estimating age distribution has been examined. The ratio of the variance between strata to the variance within strata is about 4, hence stratification by length is expected to be extremely efficient. (Auth.)

5642. Schoffman, Robert J. (Spalding Inst., Peoria, Illinois). 1963. AGE AND RATE OF GROWTH OF THE YELLOW BASS IN REELFOOT LAKE, TENNESSEE, FOR 1957 AND 1962. Journal of the Tennessee Academy of Science, Vol. 38, No. 1, pp. 12-14.

Yellow bass in Reelfoot Lake have a rapid and steady rate of growth. Few are left to die of old age and other natural causes. Since there is no creel limit or size limit for commercial and sport fishing, it is of interest to note that the growth rate of the bass is not being affected to any extent. From the view point of fish management, the protected game fish should be checked to determine if protection is beneficial to growth rate. (Auth.)

5643. Burbank, James H. (Tennessee Game and Fish Commission, Nashville). 1963. AN EVALUATION OF THE AQUATIC PEST PLANT CONTROL PROGRAM AT REELFOOT LAKE. Journal of the Tennessee Academy of Science, Vol. 38, No. 1, pp. 42-48.

The control program has significantly altered the composition of the aquatic pest plant communities at Reelfoot Lake. The changes wrought in the past fourteen years have been notable toward lotus, slight for cutgrass, and incidentally beneficial to mulefoot, an "opportunistic" which has successfully spread into the areas vacated through cutgrass removal.

Except for lotus, control efforts have been overshadowed by ecologic vegetative advancement. Obviously, unless the status quo is to be desired (and it is not) the control effort will have to be intensified to adequately combat cutgrass encroachment. New treatment measures will have to be instigated to curb the competitive tendency of mulefoot to replace cutgrass wherever cutgrass is herbicidically removed. And, improved watershed management practices to reduce the excessive siltation into Reelfoot will have to be initiated in order to effectively retard the "death" of Reelfoot Lake. (Auth.)

5644. Burke, Jack D. (Dept. of Biol., Univ. of Richmond, Virginia). 1962. DETERMINATION OF OXYGEN IN WATER USING A 10-ML. SYRINGE. The Journal of the Elisha Mitchell Scientific Society, Vol. 78, No. 2, pp. 145-147.

A procedure is described whereby dissolved oxygen can be determined in water using a 10 ml. syringe while maintaining the essential chemical entities used in the Winkler method and Alsterberg modification. Analyses can be performed in ten minutes using this syringe method. Experimental errors in duplicate analyses vary no more than 2 percent. All materials are readily obtained from supply houses. The equipment and reagents are easily transported in a small kit for field work.

5645. Lasher, R., and R. Rugh (Marine Biol. Lab., Woods Hole, Massachusetts). 1962. THE "HERTWIG EFFECT" IN TELEOST DEVELOPMENT. The Biological Bulletin, Vol. 123, No. 3, pp. 582-588.

Mature sperm of Fundulus heteroclitus were exposed to ionizing radiations from Cs.-137 at the rate of 5000 r/min., for doses ranging from 5000 r to 150,000 r, and were then used to fertilize normal eggs of the same species. Control eggs from the same batch were inseminated with unirradiated sperm from the same source.

While variations in normal fertilizability of the control eggs do occur, associated with the season and breeding activity, in every case some eggs were fertilized and developed following insemination with sperm which had been exposed to every dose level. This was not mere activation since cleavages followed.

The presence of irradiated (sperm) chromatin had no effect on the time or nature of the early cleavages. The initial adverse effects were noted at the time of gastrulation.

Exposures of sperm to 500 r had no apparent effect on the development of eggs, while exposures to 5000 r caused high mortality and morbidity, and above 5000 r (to the sperm) the effect of ionizing radiations appeared to decrease so that a greater percentage of near-normal embryos resulted from cleaving eggs.

The fact that a few specimens from 50,000 r or more sperm could not be readily distinguished from the controls suggests that complete recovery of diploidy may sometimes occur after activation. This was substantiated by cytological examination.

While parthenogenesis does not, or need not, occur naturally for this species, the fact that it can occur is of biological significance, suggesting that all vertebrates may possess eggs with such regulatory potentialities. (Authors)

5646. Richards, Sarah W. (Bingham Oceanogr. Lab., Yale Univ., New Haven, Connecticut). 1963. THE DEMERSAL FISH POPULATION OF LONG ISLAND SOUND. Bulletin of the Bingham Oceanographic Collection, Vol. 18, Article 2, 101 pp.

The standing crop of demersal fish was 0.60 g/m² at St. 1, 1.1 g/m² at St. 3A, and 0.76 g/m² for the two stations combined. The ten commonest species constituted 93% of the total standing crop; one species, Pseudopleuronectes americanus, accounted for 67%.

Such large variations in total catch occurred within those taken in a westerly direction that no statistically significant differences in total catch or in total number of species occurred between the two groups of tows. However, the number of individuals of each species was statistically significantly different between each group of tows. The varying number of individuals within each species masked any seasonal trends and locality differences which may have been present. Within each locality the fish communities were as heterogeneous as the combined community from both localities.

Throughout the year, a total of 37 different species was taken--36 of these at St. 1 and 25 at St. 3A. Analysis showed a seasonal pattern of abundance in which the total weight of the catch, but not the total number of individuals, varied proportionally with the quantity of P. americanus caught. In general, the abundance of fish, both adults and juveniles, was less in summer than at other times of year. An increase in abundance in the fall, mostly due to the influx of juveniles, was followed by a decrease early in the winter. In late winter an increase in abundance of sublittoral and diadromous species was accompanied by a decrease of adult P. americanus. An increase in the abundance of many species took place throughout the spring.

The species taken are divisible into two groups--residents and migrants. The chief residents are P. americanus, Scophthalmus aquosus, and Merluccius bilinearis, the most common migrant Stenotomus chrysops. More sublittoral residents, such as Ammodytes americanus, and juvenile migrants were taken from the sand-shell bottom of St. 1 than from the mud bottom at St. 3A.

Attempts to define the community structure, using MacArthur's (1957) hypothesis of non-overlapping niches, indicate the presence of a composite community, controlled primarily by the movements of P. americanus and other abundant species. Possibly the demersal fish population of L. I. S. will have to be arranged in "groups" other than taxonomic groups before homogeneous community structures can be determined. (Auth.)

5647. Wade, Richard A. (Inst. of Marine Sci., University of Miami, Coral Gables, Florida). 1962. THE BIOLOGY OF THE TARPON, MEGALOPS ATLANTICUS, AND THE OX-EYE, MEGALOPS CYPRINOIDES, WITH EMPHASIS ON LARVAL DEVELOPMENT. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 12, No. 4, pp. 545-622.

The larval and juvenile development of the tarpon, Megalops atlanticus, and the ox-eye, Megalops cyprinoides, are compared. A developmental series was compiled from the plankton specimens and material obtained from many sources, representing the following periods or stages of development: larval (Stage I, Stage II, Stage III A, Stage III B), and juvenile. The series is illustrated and described; and changes in form are discussed, in particular those characters useful in separating the two species.

The geographical distribution of the material studied and records from the literature are presented. The biology of both species is discussed including habitat, behavior, relationship to physical and chemical factors, natural enemies and sport-fishing qualities. (Auth.)

5648. Schröder, Roland (Walter-Schlienz-Institut, Falkau (Schwarzwald), Germany). 1962. VERTIKALVERTEILUNG DES ZOOPLANKTONS UND THERMOKLINE. Archiv für Hydrobiologie, Vol.

XXV, No. 4, pp. 401-410.

Zooplankton in Lake Constance is mostly found by the echosounder in layers with sharp gradients (thermoclines) where it is also to be found during vertical migration.

Passive displacement by vertical water movements is not compensated for within certain limits of light and probably hydrostatic pressure. If the thermocline transgresses these limits, plankton leave it.

Zooplankton, outside the thermocline, remain at the same depth despite vertical water movements.

Definite values of light intensity determine vertical distribution. Aggregation occurs where sharp temperature and chemical gradients are present.

5649. Schröder, Roland (Walter-Schlienz-Institut, Falkau (Schwarzwald), Germany). 1962. VERTIKALVERTEILUNG DES ZOOPLANKTONS IN ABHÄNGIGKEIT VON DEN STRAHLUNGSVERHÄLTNISSSEN IN SEEN MIT UNTERSCHIEDLICHEN EIGENSCHAFTEN. Archiv für Hydrobiologie, Vol. XXV, No. 4, pp. 414-429.

The deeper a species is living in a lake the more variable will be its day depth and the larger the vertical extension of its populations.

Cladocera seem to determine their day depth preponderantly by optical factors, copepods by chemical and physical factors.

Increasing depth leads, in *Daphnia*, to a displacement of the spectral center of the radiation perceived towards the region of longer wave length.

5650. Loeb, Howard A. (New York State Cons. Dept., Albany). 1962. EFFECT OF THE DYE, PLASTO PINK, ON CARP AND TROUT. New York Fish and Game Journal, Vol. 9, No. 2, pp. 142-143.

Results of feeding Plasto Pink to carp and trout revealed differences due to temperature of specific reaction or both. The dye is the second found to color fish in one feeding and may or may not be useful for short-term marking experiments involving certain species. The other dye, Sudan Black B, causes blue coloration of both trout and carp for months. Plasto Pink produced no short-term symptoms of toxicity. (Auth.)

5651. Hellier, Thomas R., Jr. (Dept. of Biol., Arlington State Coll., Arlington, Texas). 1962. FISH PRODUCTION AND BIOMASS STUDIES IN RELATION TO PHOTOSYNTHESIS IN THE LAGUNA MADRE OF TEXAS. Publications of the Institute of Marine Science, Vol. 8, pp. 1-22.

The rate of growth of populations of animal consumers depends to a considerable extent on the rate of food supply derived from photosynthetic production of plant material either within the community or that imported into the community. Yet few studies directly relate fish production to plant production. In the present study, an effort has been made to relate fish production to gross plant production in a shallow, frequently hypersaline

coastal bay, the Upper Laguna Madre of Texas.

The Upper Laguna Madre is located on the Texas Gulf Coast immediately south of Corpus Christi Bay, and is separated from the Gulf of Mexico by a narrow barrier island, Padre Island.

Biomass estimates of the animal species present were determined with a new population sampling device, the drop-net quadrat. The principle of this method is to instantaneously isolate a segment of the study area with its natural fish population, and by extrapolation determine the approximate density of the fish population of the area. Twenty-nine samples were taken over a 17 month period from March 1958 to August 1959.

Age and growth estimates of the dominant fish species were determined by scale analysis, and by reference to length frequency histograms. A total of 31 species were taken during the study, five of which constituted approximately 70 percent of the biomass. These five species were: *Mugil cephalus*, *Lagodon rhomboides*, *Leiostomus xanthurus*, *Anchoa mitchilli*, and *Menidia beryllina*.

Fish production as used in this paper was defined as the weight increase of the fish per unit time while the fish were in the study area. The monthly weight increases for all of the individuals collected during each month were totaled and placed on a per acre basis. Primary gross plant production was measured by the diurnal oxygen method with oxygen samples taken every three hours over a 24 hour period.

Biomass estimates of fish and larger invertebrates ranged from a summer maximum of 337 pounds per acre (37.8 g/m²) to a winter minimum of 18 pounds per acre (2.0 g/m²). The annual fish production estimate was 137 pounds per acre (15.4 g/m² dry weight) as compared with an annual gross primary plant production estimate of 4177 g/m²/yr expressed as oxygen. The seasonal migration and growth of fish stocks are in phase with the primary production of food. (Auth.)

5652. Breuer, Joseph P. (Texas Game and Fish Comm., Rockport, Texas). 1962. AN ECOLOGICAL SURVEY OF THE LOWER LAGUNA MADRE OF TEXAS, 1953-1959. Publications of the Institute of Marine Science, Vol. 8, pp. 153-183.

Hydrographic data and annotated comments on the distribution and habits of species are presented for the Lower Laguna Madre of Texas, a shallow, hypersaline marine bay extending 76 miles north of the Rio Grande delta. In summer, waters of the Gulf move northward through the lagoon with increasing salinity due to evaporation. The variety of species in the plankton and bottom communities diminish with distance from the pass. In winter, flow is southward. A population of commercial oysters, *Crassostrea virginica*, near the pass apparently is adapted to high salinity conditions. Some ecological effects of man-made changes are described, including the effects of opening Port Mansfield Pass, the isolation and silting of South Bay due to spoil, and the management of the Rio Grande River during floods. Movements of year classes of game fishes

are described. (Auth.)

5653. Simmons, Ernest G., and Joseph P. Breuer (Mar. Lab., Texas Game and Fish Comm., Rockport, Texas). 1962. A STUDY OF REDFISH, SCI-AENOPS OCELLATA LINNAEUS AND BLACK DRUM, POGONIAS CROMIS LINNAEUS. Publications of the Institute of Marine Science, Vol. 8, pp. 184-211.

Data on redbfish, Sciaenops ocellata, and the black drum, Pogonias cromis, are presented from 1949 to 1959. Redfish spawn in the Gulf of Mexico during fall and winter months but the exact site of this spawning is uncertain. Young fish move through passes into nursery grounds into the bays where they remain from six months to three or four years. Growth is rapid and standard lengths of 320, 530 and about 700 mm. are reached during the first three years. Spawning normally occurs at the end of the third or fourth year when the fish are 700-800 mm. long, but ripe fish as small as 450 mm. have been found. The food of redbfish is primarily crabs, but shrimp and small fish are also consumed. Migrations are much less extensive than had been supposed and intrabay movement is relatively rare. Some schools of redbfish are almost permanent residents of the Gulf while others rarely leave the bays during the first three or four years of life.

Black drum spawn in all of the bays and over any type bottom, as well as in the Gulf near passes. Most spawning takes place in February or March, but there is a prolonged or split season in May or June. Growth is less rapid than that of redbfish and standard lengths of about 160, 310, and 415 mm. are attained in the first, second, and third years. Food consists primarily of small mollusks although vegetation, small fish, polychaete worms and shrimp are also consumed. Their habit of grubbing for food is detrimental to spawning areas of trout and nursery areas of trout, redbfish and shrimp.

Redfish are sought by sport fishermen in the bays and in the Gulf. Drum are less actively sought although there is a substantial tourist fishery for this species. Commercial fishing is limited by law but about two million pounds of redbfish and drum are harvested each year by various commercial means. Catastrophic freezes occurring about every ten years have each destroyed more fish than have been harvested commercially for the past 50 years.

Drum are considered to be detrimental to trout and redbfish populations since they destroy spawning and nursery grounds, compete for food and space, and are less restricted in spawning requirements. The Laguna Madre tends to become overpopulated with this species very quickly. In an effort to reduce their effects, rough fish permits, for drum only, have been issued for certain parts of the Laguna Madre. (Authors)

5654. Hellier, Thomas R., Jr. (Arlington State Coll., Arlington, Texas), and Louis S. Kornicker. 1962. SEDIMENTATION FROM A HYDRAULIC DREDGE IN A BAY. Publications of the Institute of Marine Science, Vol. 8, pp. 212-215.

Red gravel was used to mark the bay sediment surface at 5 stations in turtle grass flats near Aransas Pass, Texas, prior to the dredging of an intracoastal waterway. Cores were taken and sediments were studied before (one week after dredging) and 18 months later. Twenty-two to 27 cm of sediment (11 to 55% silt-clay) were deposited within 0.5 mile of the dredge, but effects at greater distance were negligible. Little sediment sorting was observed during dredging. (Authors)

5655. Simmons, Ernest G. (Texas Game and Fish Comm., Rockport, Texas), and William H. Thomas. 1962. PHYTOPLANKTON OF THE EASTERN MISSISSIPPI DELTA. Publications of the Institute of Marine Science, Vol. 8, pp. 269-298.

Phytoplankton samples were obtained from over 100 stations in the eastern Mississippi delta from June 1955 through May 1957. Measurements were also made of chlorinity, temperature, suspended solids, soluble silica, phosphate, and water transparency. Five general areas were surveyed which ranged from fresh water in the Mississippi River to sea water in the open Gulf of Mexico.

The phytoplankton consisted mainly of diatoms, although a few dinoflagellates and other forms were found. Two phytoplankton associations were recognized: a river association containing species of Melosira, Cyclotella, and Navicula, and a Gulf association consisting of species of Nitzschia, Thalassiothrix, Thalassionema, Skeletonema, Chaetoceros, and Asterionella. The river population was found mainly in the river, the Gulf population in the Gulf of Mexico. Both populations were mixed in the immediate offshore area. An annotated checklist of all phytoplankton species found in this survey is presented. The phytoplankton populations during each field season are described in relation to meteorological and hydrographic conditions.

Maximum populations of phytoplankton were found from January through June in the fresher waters, and in May in the Gulf of Mexico. Minimum populations were found in the fall months. These populations were higher than have been found elsewhere in the Gulf, and more species were encountered. A few comparisons between surface samples and subsurface samples showed that nearly all of the cells were at the surface, except in the river where the water was well mixed. (Authors)

5656. Darnell, Reznat M. (Dept. of Biology, Marquette Univ., Milwaukee, Wisconsin). 1962. FISHES OF THE RIO TAMESI AND RELATED COASTAL LAGOONS IN EAST-CENTRAL MEXICO. Publications of the Institute of Marine Science, Vol. 8, pp. 299-365.

A total of 11,043 specimens of fishes was obtained in 66 collections from the tributaries of the Rio Tamesi and from a coastal lagoon near Tampico. Sixty species of fishes are now recognized from the area, 23 of which are fresh-water forms and 37 of which are considered to be euryhaline. For each species information is given, if available, regarding the following: nomenclature,

distribution, salinity relations, general ecology, food habits, and reproduction.

For both the fresh-water fishes and the littoral marine fishes, eastern Mexico represents a zone of transition between the temperate and tropical faunas. Among the fresh-water species of the Tamesi, representatives of southern families slightly outnumber representatives of northern families (13:10). Among the euryhaline species, representatives of southern families greatly predominate over those of northern families (35:2). Analysis of habitat distribution of the fresh-water fishes of the Tamesi reveals that those of southern derivation inhabit primarily the small upstream waters, whereas those of northern affinity are chiefly inhabitants of larger and downstream waters. These phenomena are discussed in terms of faunal centers and barriers to dispersal. (Auth.)

5657. Deane, Roger E. (Great Lakes Inst., Univ. of Toronto, Canada). 1963. LIMNOLOGICAL AND METEOROLOGICAL OBSERVATION TOWERS IN THE GREAT LAKES. *Limnology and Oceanography*, Vol. 8, No. 1, pp. 9-15.

Six limnological and meteorological single-shaft towers of 4-inch pipe were installed in 3 of the Great Lakes by the Great Lakes Institute, University of Toronto. The towers were of two types, a shallow-water tower for depths of less than 60 feet where the base of the tower rested directly on the lake bottom, and a deep-water tower supported by a buoyancy tank 25 feet below lake level. A platform on the towers, situated 8 to 12 feet above lake level, gave a stable base to house limnological and meteorological instruments and recorders. The platform and upper part of tower were designed for easy removal and reinstallation. (Auth.)

5658. Dorris, Troy C., B. J. Copeland (Oklahoma State Univ., Stillwater), and Gerald J. Lauer. 1963. LIMNOLOGY OF THE MIDDLE MISSISSIPPI RIVER. IV. PHYSICAL AND CHEMICAL LIMNOLOGY OF RIVER AND CHUTE. *Limnology and Oceanography*, Vol. 8, No. 1, pp. 79-88.

During the period November 1954 to January 1956 weekly determinations were made of various limnological factors in the Mississippi River and Cottonwood Chute near Quincy, Illinois. Information was obtained on temperature, ice cover, stream discharge, precipitation, current velocity, turbidity, color, alkalinity, pH, carbon dioxide, dissolved oxygen, total dissolved solids, total and suspended organic solids, photosynthetic productivity, and respiration. Stream discharge exerted an overriding influence on most factors. Periods of high stream discharge were generally accompanied by increased turbidity, carbon dioxide, and solids, by lowered and more uniform temperatures, and by decreased dissolved oxygen and photosynthetic productivity. Opposite effects were observed at periods of low stream discharge. (Authors)

5659. Herman, Sidney S. (Dept. of Biology and Marine Science Center, Lehigh Univ., Bethlehem,

Pennsylvania). 1963. PLANKTONIC FISH EGGS AND LARVAE OF NARRAGANSETT BAY. *Limnology and Oceanography*, Vol. 8, No. 1, pp. 103-109.

Planktonic fish eggs and larvae were collected weekly at 4 stations in Narragansett Bay, over a period of one year from March 1957 to March 1958. Thirty-six species of fish eggs and larvae were identified.

The peak in spawning activity occurred from late May through mid-August. The peak of fish egg production occurred in June and July, and the period of low abundance occurred between September and February. Peaks of larval abundance were found in July and August and again in January and March. Deeper areas in the Bay contained greater concentrations and a greater variety of species than did the shallow areas. (Auth.)

5660. Miller, Rudolph J. (Dept. of Zoology, Oklahoma State Univ., Stillwater). 1963. COMPARATIVE MORPHOLOGY OF THREE CYPRINID FISHES: NOTROPIS CORNUTUS, NOTROPIS RUBELLUS, AND THE HYBRID, NOTROPIS CORNUTUS X NOTROPIS RUBELLUS. *The American Midland Naturalist*, Vol. 69, No. 1, pp. 1-33.

Samples of Notropis cornutus, Notropis rubellus and their hybrid(s) were collected from Catatonk Creek near Candor, New York. Twenty-seven external characters and numerous internal characters were examined; five meristic, eleven morphometric, three qualitative external and six internal characters proved valuable in comparing the three forms. In most characters where the parent species differed, hybrids were variously intermediate. In a few characters, however, hybrid values approached those of one or the other parent. I was unable to establish the presence of backcrosses and/or F₂ hybrids in this population on the basis of morphological criteria. (Auth.)

5661. Hanson, Willis D. (Missouri Cons. Comm., Columbia), and Robert S. Campbell. 1963. THE EFFECTS OF POOL SIZE AND BEAVER ACTIVITY ON DISTRIBUTION AND ABUNDANCE OF WARM-WATER FISHES IN A NORTH MISSOURI STREAM. *The American Midland Naturalist*, Vol. 69, No. 1, pp. 136-149.

The linear distribution of fishes appeared to be related to stream gradient and area of the watershed; headwater species occurred where the gradient was 8.2 feet per mile, and the watershed area was less than 93 square miles. The influence of large deep pools on species distribution is possibly more significant than, and superimposed on, this basic pattern. The presence of beaver pools in the headwater section affected fish habitat through (1) a greatly increased volume of water; (2) providing deep pools in times of intermittent stream flow; (3) increasing variety of fish habitat. The effect of beaver pools on the fish population was seen in (1) an increased variety and abundance of species; (2) a greatly increased standing crop.

The standing crop of plankton in beaver pools was approximately five times as great as in the

stream proper.

Whereas land use and stream straightening frequently have deleterious effects on fish populations because of silt deposition and shallowing of pools, beaver activity appeared to improve the carrying capacity of the stream for warm-water fishes. (Authors)

5662. MacDonald, Theodore H. (Dept. of Zoology, Univ. of Western Australia, Nedlands, Western Australia). 1963. RATES OF GROWTH IN BRITISH AMMOCOETES. The American Midland Naturalist, Vol. 69, No. 1, pp. 198-204.

Three species of lamprey are found in Britain: Petromyzon marinus (Linnaeus), Lampetra fluviatilis (Linnaeus), and Lampetra planeri (Bloch). Ammocoetes of all three species formed the object of these investigations. Rates of linear growth were estimated by conventional sampling procedures. In addition ammocoetes were reared under laboratory conditions in order to arrive at more accurate parameters. Rates of change in weight as the ammocoetes developed were recorded. A marked decrease in body weight and length took place during the final months of metamorphosis in ammocoetes of all three species. In the first year of larval life, body weight increased at a greater rate than at any other period in the ammocoete life. From the third year on, there occurred wide differences between the species as far as relationship between age and weight are concerned. Both L. planeri and P. marinus metamorphose after 5 1/2 years of larval life, while L. fluviatilis requires 6 years. (Auth.)

5663. Graham, T. R., and J. W. Jones (Zoology Dept., Univ. of Liverpool, England). 1961. THE BIOLOGY OF LLYN TEGID TROUT. Proceedings of the Zoological Society of London, Vol. 139, Part 4, pp. 657-683.

This paper reports the results of an interim investigation into the biology of the brown trout Salmo trutta L. of Llyn Tegid (Bala Lake), North Wales. Earlier investigations on the biology of the trout were completed before the controlled-outflow scheme came into operation in 1955. This scheme has lowered the mean and range of the lake level. A comparison is made between the fish sampled in 1953/4 and those sampled in 1959/60. The latter fish showed a decrease in growth, condition, food intake and calorific value of the diet. It is concluded that the scheme is responsible for this by decreasing the productivity of the lake and by changing the quantitative composition of the bottom organisms consumed by the fish. It is suggested that these changes may be temporary. (Authors)

5664. Molander, Arvid R. 1961. STUDIES OF THE FAUNA IN THE FJORDS OF BOHUSLÄN WITH REFERENCE TO THE DISTRIBUTION OF DIFFERENT ASSOCIATIONS. Arkiv för Zoologi, Serie 2, Band 15, Nr. 1, pp. 1-64.

I have attempted in this account to give a

concise picture of the associations in the waters of Bohuslän, and at the same time test their value from a faunal point of view in order to judge the distribution of the bottom fauna from the aspect of zoogeography. It has been necessary to study the associations in their relation to different biotopes and their boundaries in relation to each other. It has also been of the greatest importance to determine the composition of the type species groups and their significance in the classification and limitation of the associations. Even if it has been possible to demonstrate the existence of clear and well-delimited associations in the areas studied, and to trace their distribution, there still remain important problems that I hope new studies will solve.

It seems to be of value that the investigations reported here have emphasized so clearly that the concept of association that I advanced in my earlier work has proved to be, on the whole, so valid, and that the division into associations then made can be maintained. When one takes into consideration the varying nature of the biotopes and the great numerical strength and wealth of variations of the fauna, it is only natural that transitional forms may arise, but that does not detract from the value of the association as a starting point in zoogeographical studies. (Auth.)

5665. Frank, Stanislav (Dept. of Zoology, Lab. of Ichthyology, Charles' Univ., Prague). 1962. A CONTRIBUTION TO THE GROWTH AND FOOD BIOLOGY OF THE BROWN TROUT SALMO TRUTTA TRUTTA M. FARIO AND SALMO TRUTTA LABRAX M. FARIO IN SOME WATERS OF CZECHOSLOVAKIA. Věstník Československé Společnosti Zoologické, Vol. 26, No. 4, pp. 316-328.

In spite of the fact that brown trout in our waters use aquatic fauna, as well as dry-land insects, as food, their growth in our brooks and small rivers is not rapid. The reasons for this can be spatial or lack of food, which would be difficult to estimate quantitatively, apart from the continuous changes and the continually increasing pollution of our waters, especially in recent times. It is certain, however, that if specimens growing relatively slowly in a brook are confined e. g. to a newly built valley basin, their growth within the inundation territory becomes quicker. (Auth.)

5666. Christensen, Earl M. (Dept. of Botany, Brigham Young Univ., Provo, Utah). 1962. BIBLIOGRAPHY OF UTAH AQUATIC BIOLOGY, NO. II. The Great Basin Naturalist, Vol. XXII, Nos. 1-3, pp. 32-53.

In 1956, a bibliography containing 243 references to Utah aquatic biology was compiled by the author. This is the second bibliography dealing with Utah aquatic biology and it supplements the 1956 bibliography. This second bibliography contains 390 references dated prior to December 31, 1961. Most of these references are to papers written since 1956. The total number of citations to Utah aquatic biology in these two bibliographies is 633. Twenty-seven unsigned articles are cited.

5667. Christie, Ronald M. (Dept. of Lands and Forests, Maple, Ontario, Canada), and Helen I. Battle. 1962. HISTOLOGICAL EFFECTS OF 3-TRIFLUORMETHYL-4-NITROPHENOL (TFM) ON LARVAL LAMPREY AND TROUT. Canadian Journal of Zoology, Vol. 41, No. 1, pp. 51-62.

Larvae of the lamprey, *Entosphenus lamottei* (Le Sueur), and rainbow trout, *Salmo gairdneri* Richardson, were exposed to the sodium salt of 3-trifluoromethyl-4-nitrophenol (TFM) in concentrations of 0.75 p.p.m., 3.00 p.p.m., and 6.00 p.p.m. Microscopic examination of changes induced in the gills, liver, cloacal region, and musculature were made on 7-micron sections stained with Harris' haematoxylin and Bowie's eosin, and in the gill region with periodic acid Schiff reagent. A comparison of the degree of the effects in the two species was made by planimetry of the vascular, cellular, and edematous areas from enlarged drawings of sections.

Upon exposure to lethal concentrations of TFM, the body of the larval lamprey becomes distended at the pharyngeal level and heavy cords of mucus emerge from the external gill clefts. A deep red coloration is evident in the pharyngeal region consequent upon vasodilatation of the arterioles and capillaries of the gill filaments. Trout exhibit a similar vasodilatation of the gills together with increased mucous secretion. Edema in the connective tissue between the respiratory epithelium and the vascular endothelium is induced in both species. After prolonged exposure to TFM, the mucous cells in the lining of the branchial chamber and covering the tips of the gill filaments are actively discharging their secretions or completely spent.

Certain effects induced by TFM in the larval lamprey are not evident in the trout. The cloacal region takes on a deep red coloration due to dilatation of the venous sinuses and the liver becomes reddish because of sinusoidal dilatation. Extensive edema of the fibrous connective tissue of the skeletal musculature is characteristically present. A slightly increased secretory activity of mucous-secreting cells may occur in the epidermis.

With the techniques employed in this study, there was no evidence in either species of cytological or histological changes in the nervous tissue, cardiac musculature, notochord, alimentary canal (including the haemopoietic typhlosole of the lamprey), or mesonephros. (Authors)

5668. Pfeiffer, Wolfgang (Dept. of Zoology, Univ. of British Columbia, Vancouver, B. C., Canada). 1962. THE FRIGHT REACTION IN NORTH AMERICAN FISH. Canadian Journal of Zoology, Vol. 41, No. 1, pp. 69-77.

The fright reaction was found in five species of North American Cyprinidae including the predaceous northern squawfish, and in two species of Catostomidae. The threshold for Cyprinidae is 1/1000 N ("normal") extract or lower, that for Catostomidae at least a 1/100 N extract. The cyprinid species reacted very strongly to extract

from other Cyprinidae but less strongly to catostomid extract; catostomid species reacted strongly to extract from other Catostomidae but less strongly to cyprinid extract. Salmon extract did not produce any reaction in Cyprinidae or Catostomidae. The epidermis of all species studied contained alarm substance cells; the epidermis of the Catostomidae was very similar to that of the Cyprinidae. There was a relationship between number and size of the alarm substance cells (histology) and the quantity of alarm substance in the fish skin (physiology). The ability to respond to the alarm substance first appeared in young reidside shiners at an age of 42 days, in young zebrafish at an age of 32 days, when the fish were kept at 26° C. (Auth.)

5669. Niazi, I. A. (Dept. of Zoology, McGill Univ., Montreal, Quebec, Canada). 1962. THE HISTOLOGY OF TAIL REGENERATION IN THE AMMOCOETES. Canadian Journal of Zoology, Vol. 41, No. 1, pp. 125-146.

Ammocoetes of both *Petromyzon marinus* and *Entosphenus lamottenii* are able to regenerate morphologically complete tails, although at a slow rate. This ability persists in the lampreys throughout the larval life. Regeneration occurs via dedifferentiation of stump tissues and formation of the blastema. The tissues in the posterior region of the stump lose their specialized features and release dedifferentiated mononucleate cells, which migrate distally to form the blastema under the epidermal cap covering the amputation surface. Great mitotic activity appears in the tissues of the posterior part of the stump during the process of dedifferentiation following amputation of the tail. The blastema is formed by cellular contributions from the muscles, notochord, cartilaginous elements, and the general connective tissue of the stump. All these tissues arise de novo in the regenerated tail from redifferentiation of the blastema cells, and follow the ontogenetic mode of development not only in histogenesis but also in the sequence in which they appear. No precocious developments occur in the regenerating tails of the lamprey larvae. For the redifferentiation of the notochord in the blastema an actual histological connection with the stump notochord is not necessary. The regeneration of the spinal cord, after tail amputation, is also largely a new development involving a great degree of dedifferentiation followed by redifferentiation of the cells derived from the corresponding organ in the stump. The regenerated spinal cord is anatomically a complete organ. At least three to four pairs of spinal ganglia are regenerated. (Auth.)

5670. Nakamura, Eugene L. (U. S. Bur. of Comm. Fish. Biol. Lab., Honolulu, Hawaii). 1962. OBSERVATIONS ON THE BEHAVIOR OF SKIPJACK TUNA, *EUTHYNNUS PELAMIS*, IN CAPTIVITY. Copeia, 1962, No. 3, pp. 499-505.

Maintenance of skipjack tuna, *Euthynnus pelamis*, in captivity for periods up to 5 1/2 months enabled various behavioral observations to be made.

Food consumption per pound of skipjack per day when fed to satiation every hour was twice that when fed to satiation once a day. Passage of shrimp exoskeleton through the digestive tract took 1 1/2 hours. The skipjack were conditioned to water slapping as a feeding signal. They did not prey upon small fishes in their pool. Bright blue streaks on the posterior dorsal and dorsolateral surfaces, the white anterior edge of the first dorsal fin, the silvery tongue, and dark vertical bands on the dorsolateral surfaces when feeding are some color features seldom or never observed in dead skipjack. Two size groups formed a single school which was disrupted only during feeding. The skipjack swam with their mouths constantly agape, never stopped swimming, and showed no rheotaxis. Growth from 2 to 3 pounds occurred within 3 months. Recovery from injuries was noted. Causes of mortalities were undetermined, but an inadequate diet was suspected. (Auth.)

5671. Branson, Branley A. (Dept. of Biol., Kansas State College, Pittsburg). 1962. OBSERVATIONS ON THE BREEDING TUBERCLES OF SOME OZARKIAN MINNOWS WITH NOTES ON THE BARBELS OF HYBOPSIS. Copeia, 1962, No. 3, pp. 532-539.

The arrangement of nuptial tubercles is compared in Notropis pilsbryi, N. rubellus, Dionda nubila, Hybopsis biguttata and H. x-punctata. An attempt is made to correlate the distribution of these structures with the breeding behavior and ecology of the species. Species which are very active spawners or which spawn in rapidly flowing waters have more extensively developed tubercles than sedate ones. Tubercle patterns, if used as indicative characters of phylogeny, should be correlated with behavior and life-history data. Some remarks are included on the morphology of barbels in Hybopsis x-punctata, H. biguttata, H. micropogon, H. aestivalis and others. (Auth.)

5672. Iversen, E. S., and D. C. Tabb (Univ. of Miami, Inst. of Marine Science, Miami, Florida). 1962. SUBPOPULATIONS BASED ON GROWTH AND TAGGING STUDIES OF SPOTTED SEATROUT, CYNOSCION NEBULOSUS, IN FLORIDA. Copeia, 1962, No. 3, pp. 544-548.

Analyses of subpopulations of spotted seatrout were made using growth and tagging data from several locations along the coast of Florida (Cocoa, Flamingo, Fort Myers, Cedar Key, and Apalachicola). Growth rates from these areas show differences that suggest subpopulations of this species. These findings agree with tagging results wherein 95 percent of recaptured seatrout moved less than 30 miles from where they were tagged. Results of the two studies suggest a close association of the seatrout with the local environment. (Authors)

5673. Distler, D. A., and A. L. Metcalf (Museum of Natural History, The Univ. of Kansas, Lawrence). 1962. ETHEOSTOMA PALLIDIDORSUM, A NEW PERCID FISH FROM THE CADDO RIVER SYSTEM

OF ARKANSAS. Copeia, 1962, No. 3, pp. 556-561.

Etheostoma pallidorsum (subgenus Oligocephalus) is described and compared with E. cragini, the darter which it most closely resembles. The pale-back darter is known only from the headwaters of Caddo (Ouachita) River System, whereas E. cragini is endemic to the Arkansas River System; the species differ in details of squamation, pigmentation, and shape. (Authors)

5674. Breder, C. M., Jr. (Dept. of Ichthyology, American Museum of Natural History, New York, New York). 1962. ON THE SIGNIFICANCE OF TRANSPARENCY IN OSTEICHTHID FISH EGGS AND LARVAE. Copeia, 1962, No. 3, pp. 561-567.

Largely transparent osteichthid eggs and larvae are mostly associated with brightly illuminated places and are of most common occurrence as oceanic pelagic eggs. Hatching occurs at which is evidently the earliest possible time. This type of egg and larva is more widespread in the superciform fishes. Often present many of the more specialized acanthopterygians are slow hatching, heavily pigmented eggs, usually adhesive and mostly placed in shaded locations.

Transparency and opacity are both recognized as specializations in the protection against deleterious effects of radiations chiefly in the visible range, the first permitting the radiation to pass through without absorption and the second blocking it from impingement on labile structures or systems.

Intermediates and random exceptions to the above are not sufficiently numerous to invalidate the generalizations expressed, which are supported by many auxiliary details.

Fishes which produce these hyaline, pelagic eggs usually have well exposed pineal organs and generally exercise no parental care, while those which produce heavily pigmented demersal eggs usually have well covered pineal organs and often do exercise parental care. Intermediates often have pigmentary control of the chromatophores over the pineal area and exercise it to occlude the pineal in the dark but expose it in the light.

The association of pigmented eggs laid in dark places with covered pineal areas and of hyaline eggs laid in brightly lighted places with exposed pineal areas suggest that there is here a primary condition governed by events at the enzymatic or molecular level. At the organismic level the role transparency plays in protecting against predation would seem to be of a secondary value especially as much predation on plankton is carried out on an essentially nonvisual basis. (Auth.)

5675. Roberts, Nicholas J., and Howard E. Winn (Dept. of Zoology, Univ. of Maryland, College Park). 1962. UTILIZATION OF THE SENSES IN FEEDING BEHAVIOR OF THE JOHNNY DARTER, ETHEOSTOMA NIGRUM. Copeia, 1962, No. 3, pp. 567-570.

Tests using vials of live worms, dead worms, and worm extract demonstrated that feeding responses (the peck) by the darters are primarily

elicited by visual cues of movement. Fish responded slightly to olfactory cues. A correlation exists between the use of the visual sense and the structure of the brain in the Johnny darter. (Authors)

5676. Piavis, George W. (Dept. of Anatomy, Dental School, Univ. of Maryland, Baltimore). 1962. EXPOSURE OF SEVERAL DEVELOPMENTAL STAGES OF THE SEA LAMPREY, PETROMYZON MARINUS, TO SELECTIVE LARVICIDES. Copeia, 1962, No. 3, pp. 652-653.

Sea lamprey at several different developmental stages were exposed to chemicals that are selectively toxic to lamprey larvae. The earlier embryonic stages (unfertilized ovum through prehatching, Stages 0 through 13) were exposed to test chemicals for a period of 24 hours. Development proceeded beyond the stage at treatment for 1 to 3 additional stages before death ensued. In all cases, criterion of death was disintegration of the embryo. Prolarval stages (larva still bearing yolk, Stages 14 through 17) exposed to larvicides for the entire experiment withstood treatment until they entered Stage 18 (larva), whereupon death came rather suddenly. Stage 18 larvae died within hours after exposure. An inhibition of the hematopoietic system seemed to occur in those prolarvae treated prior to Stage 15 (pigmentation). Stream treatment with larvicides for the control of sea lampreys apparently should be accomplished 40 days after spawning has ceased to insure destruction of larvae in the more highly susceptible stages. (Auth.)

5677. Orton, Grace L. (Univ. of California, Scripps Inst. of Oceanography, La Jolla). 1962. PREDATION OF THE SEA LAMPREY, PETROMYZON MARINUS, ON THE ATLANTIC MACKEREL, SCOMBER SCOMBRUS. Copeia, 1962, No. 3, pp. 663-665.

During May 1961, recreational fishermen angling for mackerel off Deb's Inlet, Long Island, New York, reported that many of the fish had sea lampreys attached. Examination of three specimens, 202 mm, 204 mm, and 237 mm in total length, brought in by anglers during the period 20-27 May 1961, confirmed their identification. (Auth.)

5678. Onodera, Kosi (399 Miya, Hino-machi, Minamitama-gun, Tokyo, Japan). 1962. CARRYING CAPACITY IN A TROUT STREAM. Bulletin of Freshwater Fisheries Research Laboratory, Vol. 12, No. 1, pp. 1-41.

Throughout the three years' experimentation, stability of stock biomass was manifest. The stability was ascertained in two ways; in total annual stock biomass and in each stock biomass measured specifically.

The carrying capacity of the brook was determined as 2.39 g/m² at the highest and as 0.79 at the lowest.

The causes of population reduction were observed to be scouring out by floods, emigration out of the experimental section, and predation. These factors seemed to act on the fingerlings

planted in excess of the carrying capacity of the brook. However, natural death other than the above-mentioned causes of decrease was not ascertained.

As the most fundamental cause at the root of all the above three causes which lead to the stability of fish biomass may be mentioned the social interference among individuals of the same and/or different species of trout. Establishment of a series of peck order was observed on the individual level at first. Agencies to bring about the establishment of the peck order were the kind and amount of food materials, facilities for securing them, and shelters. The significance of shelters preferred against flood or high water was apparently observed.

In securing facilities for the maintenance of the life of fingerlings, violent fights were observed especially when the environmental conditions were changing for the worse, as when there was a gradual decrease of flow in a drought or an increase in a flood.

The peck order seen on individual level changed soon into a social order at the population level. The smaller fingerlings either migrated downstream or perished in a flood, thus resulting in a thick distribution of larger fingerlings in the upper pools or section, and a similar distribution or smaller fingerlings in the lower pools or section.

Specific advantage in adapting to environmental conditions was observed in wild rainbow trout fingerlings over stocked brook trout fingerlings. This was observed through the occupation of home range and ascertained in the pattern of growth curves. Although no specific disadvantage was observed in the causal factors, a decisive and early depression of the survival curve of BK_g was noted. The initial smaller size of the individuals of the planted population might be assumed to be the cause.

The mortalities by predation amounted to 94% of the total mortalities, of which 97% were caused by piscivorous birds and only 3% by resident trout.

Competition, existence of definite limits in the number of shelters and facilities for securing food, and existence of annual limits in the supply of food materials by flowing water were regarded as autochthonous agencies, while predation by piscivorous birds and floods as allochthonous agencies. Stocked populations struggled against population-decreasing agencies by changing their usual behavior in securing shelter in case of floods and widening the food collecting area in case of drought.

Dynamic equilibrium between the demands of fingerlings to maintain their lives and the supplies of these materials or the condition of the ecosystem of the stream may balance annually in magnitude and extent.

Elimination of inferior individuals from the area of limited conditions or factors is a process of natural selection and this works as the most profound agency for maintaining equilibrium cooperated by the striving of each individual for sticking to the undulating center of the gradient of the conditions or factors preferred. (Auth.)

5679. Sano, Osamu. 1962. THE INVESTIGATION OF SALMON SHARK AS A PREDATOR ON SALMON IN THE NORTH PACIFIC, 1960. Bulletin of the Hokkaido Regional Fisheries Research Laboratory, No. 24, pp. 148-162.

From April to August, salmon sharks live in the same region as salmon. In the sub-Arctic, migrating salmon sharks are divided at about 46°-47° N. L. into two different groups; northern, large ones and southern, small ones. This division is not caused by race, but by age.

Like oceanic sharks in general, salmon sharks are in the habit of feeding without discrimination, so they may be called "opportunistic feeders". In the months from May to August in Aleutian waters, a large part of the animals eaten were sockeye salmon in 1959, while in 1960, they were squids. The composition of the contents in salmon sharks' stomachs show different tendencies by year and by place, and those tendencies are related with the oceanic factors, the composition of the available fish food such as salmon, and the changes of the quantitative relation between salmon sharks and salmon.

Salmon sharks are harmful, eating large quantities of useful salmon. (Auth.)

5680. Okubo, Katsuwo, and Takako Okubo. 1962. STUDY ON THE BIO-ASSAY METHOD FOR THE EVALUATION OF WATER POLLUTION. II. USE OF THE FERTILIZED EGGS OF SEA URCHINS AND BIVALVES. Bulletin of Tokai Regional Fisheries Research Laboratory, No. 32, pp. 131-140.

In order to evaluate the toxicity of pollutants encountered in water pollution of coastal areas, a method of bio-assay has been developed by using artificially fertilized eggs of sea urchins and bivalves as test organisms.

The effects of pollutants on the development of eggs were easily recognizable in disturbed metamorphosis.

Four species tested (two species each for sea urchins and bivalves) were similar in sensitivity to pollutants. Although the spawning season of the species reported upon covers only summer and winter, the findings suggest a possibility of establishing a bio-assay method for any season if some other species that are taxonomically related with them and produce artificially fertilizable eggs are chosen as test organisms.

The sensitivity of the present test organisms to pollutants was much higher than that shown by other test organisms.

The morphologically non-effective concentration of some pollutants for the embryonic development of sea urchins and bivalves may be equal to the safe level of the pollutant concentration for littoral fishes. (Authors)

5681. Gilbert, Carter R., and Reeve M. Bailey (Dept. of Biology, Univ. of Florida, Gainesville). 1962. SYNONYMY, CHARACTERS, AND DISTRIBUTION OF THE AMERICAN CYPRINID FISH, NOTROPIS SHUMARDI. Copeia, 1962, No. 4, pp.

807-819.

The troubled nomenclatural history of Notropis shumardi (Girard) of the Mississippi basin is recounted, with the conclusion that N. illecebrosus (Girard) is a synonym. The species is redescribed, and its geographic variation in several characters is studied. In the Alabama River, in the Red River, and in the Brazos, Colorado, and several smaller rivers of Texas the silverband shiner has a reduced number of anal rays and of vertebrae, but the pattern of variation and the lack of consistency in counts furnish evidence to deny nomenclatural recognition to these geographically peripheral stocks. Notropis brazosensis Hubbs and Bonham is accordingly placed in the synonymy of N. shumardi. Notropis shumardi is an inhabitant of large, usually turbid rivers and ranges from South Dakota to Indiana, Alabama, and Texas; it has probably dispersed from an origin in the Mississippi Valley. The record stations are listed and are mapped. Notropis shumardi may be placed among the species centering in Notropis atherinoides; it is probably most intimately related to N. perpallidus. (Authors)

5682. Burke, Jack D. (Dept. of Biology, Univ. of Richmond, Virginia). 1962. A SIMPLE TECHNIQUE FOR IMMOBILIZING FISH TO REMOVE BLOOD. Copeia, 1962, No. 4, pp. 852-854.

A holder for securing fish is described.

5683. Grizzell, Roy A., Jr., and William W. Neely (Soil Cons. Serv., Little Rock, Arkansas). 1962. BIOLOGICAL CONTROLS FOR WATER-WEEDS. Transactions of the Twenty-Seventh North American Wildlife and Natural Resources Conference, pp. 107-113.

Two genera of algae often are serious problems in southeastern ponds. Pithophora grows in freshwater fish ponds, and Cladophora in brackish-water duck ponds. No suitable chemical has been found to control either one.

Field trials in Georgia and Arkansas confirm research at Auburn, Alabama, that it is practical to establish effective biological reduction of Pithophora in bass-bluegill ponds by using Israeli carp. It was necessary to stock with 5- to 6-inch fish, rather than smaller fingerlings, to prevent large-mouth bass from depleting the stocking. Indications are that 50 carp per acre is sufficient.

Field trials in coastal South Carolina proved that Cladophora can be effectively controlled in widgeongrass duck ponds by introducing mullet. Stocking is accomplished by opening the control gates to take water into the ponds on high tides, at seasons when schools of fingerling mullet are observed in adjacent creeks. The fingerling mullet thus come in with the water. The rate of stocking is not known.

Duckweeds occur in farm ponds that are protected too well from wind and wave action. Chemical and mechanical control measures are but temporarily effective. It was found that six or more Muscovy ducks per acre will control duckweeds in ponds. A method of protecting these ducks

from predation is described.

Adequate winter and summer fertilization will control submersed waterweeds in ponds not having extensive shallow edges. (Authors)

5684. Crutchfield, James A. (Univ. of Washington, Seattle). 1962. VALUATION OF A FISHERY. Transactions of the Twenty-Seventh North American Wildlife and Natural Resources Conference, pp. 335-347.

In brief, the prospects for finding the universal method for the valuation of sport fishing are dim. There is no more reason to expect uniform values per day or per fish for sport fishing than for acres of farm land or bushels of potatoes. What we need are uniform principles, which can be applied to a variety of unique situations. We are really handcuffed because the enormous assistance of the market price mechanism, reflecting the collective informed decisions of users of the service, is not available to us.

The Clawson approach does not hold real promise in some special cases, and much can be accomplished in terms of orders of magnitude even where absolute measures of value are not obtainable. Sampling can provide reasonable estimates of angler days and numbers of individual fishermen. Faced with any of several types of policy decisions (the construction of a dam, for example), we can estimate the total dollar value and amount per angler which would be required to move the project out of the feasibility range. Common sense may then suffice to judge the reasonableness of this minimum significant value for the sport fishery affected. Similar reasoning may be usefully applied where the issue involves competing sport and commercial fisheries. We need not, after all, argue for perfection or no economic analysis as the only alternatives.

Finally, I should like to offer, in the face of certain disapproval by a majority of professionals in the field, a plea for more realistic pricing of sport fishing. There is no obvious reason why we should not levy charges for sport fishing licenses which cover at least part of the real economic value of the privilege conferred. At present income levels this will not work any real hardship on the great mass of fishermen, and it will give us an indispensable statistical toehold on the basic problem. Paradoxical as it may seem, the insistence on virtually free access to sport fishing may have the effect of closing off the information which would do most to guarantee its preservation and growth. (Auth.)

5685. Clark, John R. (Sandy Hook Marine Lab., Bur. of Sport Fish. and Wildl., Highlands, N. J.). 1962. SALT-WATER ANGLING AND THE RESOURCES PROBLEM. Transactions of the Twenty-Seventh North American Wildlife and Natural Resources Conference, pp. 347-350.

Thorough analysis of the status of our seafood resources cannot be made until extensive current statistics on angling are available. This requires

a widespread cooperative statistical collection program along the whole U. S. coastline. (Auth.)

5686. Miller, Robert Rush (Univ. of Michigan, Ann Arbor). 1963. SYNONYMY, CHARACTERS, AND VARIATION OF GILA CRASSICAUDA, A RARE CALIFORNIA MINNOW, WITH AN ACCOUNT OF ITS HYBRIDIZATION WITH LAVINIA EXILICAUDA. California Fish and Game, 49(1): 20-29.

The thicktail chub is extremely rare or now extinct over its entire range in the Central Valley, Clear Lake, and Coyote Creek of California. The last known specimen (illustrated) was captured in 1950 from the Sacramento River near Rio Vista. The species is diagnosed, and its nomenclatural history, meristic and morphometric variation, habitat, life colors, former abundance, and food value are treated. The study is based on 101 specimens (listed), probably representing 98 percent of existing museum specimens. Natural hybridization with the hitch is documented for the first time; the five hybrids are close to intermediacy in most of their features, and probably represent the F₁ generation. It is suggested that the dermosphenotic bone (reviewed for the genus Gila) may be too variable for utilization as a structure for delimiting major evolutionary lines in the Cyprinidae (as was done by Tertiakov). Reasons for the hybridization between Gila crassicauda and Lavinia exilicauda are presented. (Auth.)

5687. Murphy, Garth I. (Scripps Inst. of Oceanography, La Jolla, California). 1963. TROUT SURVIVAL IN TAYLOR CREEK, A TRIBUTARY OF LAKE TAHOE, CALIFORNIA. California Fish and Game, 49(1): 16-19.

During the summer of 1940, a short-term experiment on trout survival was conducted in a 295-foot section of Taylor Creek, tributary to the southwest end of Lake Tahoe, California. A minimum of 10.6 percent of 500 hatchery rainbow trout fingerlings survived after a month in the stream. Wild rainbow trout-of-the-year had an 11.7 percent survival. Low survival is thus indicated where competition and predation are as great as they were here, and shade and shelter are limited.

Late summer and early fall seem to be extremely critical times in the life histories of many fishes. The mortality of Richardsonsonius was very high, large numbers of Catostomus-of-the-year suddenly moved upstream, enormous numbers of Rhinichthys seemed to move toward Lake Tahoe, and trout-of-the-year started to move upstream at the end of August, when the water level was dropping. (Auth.)

5688. Chapman, Gordon A. (California Dept. of Fish and Game, Terminal Island). 1963. MISSION BAY, A REVIEW OF PREVIOUS STUDIES AND THE STATUS OF THE SPORTFISHERY. California Fish and Game, 49(1): 30-43.

The sportfishery of Mission Bay, San Diego, California, is discussed, based on interviews of 1,024 anglers who caught 0.156 fish per hour between January and June 1961. Fishing success

for 1961 and previous years is compared. A history of the physical development of Mission Bay, a list of fish species occurring there, and facilities available to anglers are also presented. (J. L. B.)

5689. Smith, Albert C. (California Dept. of Fish and Game, Terminal Island). 1963. VARIANT HEMOGLOBIN AND ELECTROPHORETIC WHOLE BLOOD STUDIES IN TWO TUNAS AND THREE OTHER FISH SPECIES. California Fish and Game, 49(1): 44-49.

Studies were carried out to determine if variant hemoglobin and electrophoretic whole blood patterns existed among two tuna and three other fish species. Addition of reducing agent (sodium bisulfite) to fresh red cells of northern anchovies (Engraulis mordax), rubberlip perch (Rhacochilus toxotes), and spotted bass (Paralabrax maculatofasciatus) revealed no sickling of cells and, therefore, the apparent absence of sickle cell type hemoglobin in these fish. Electrophoresis of whole blood from the kelp bass (Paralabrax clathratus), Pacific albacore (Thunnus germon), and California bluefin tuna (T. saliens) revealed intraspecific pattern variation in all but the albacore.

Large enough differences in the frequency of any clearly rare electrophoretic blood curve in separate fish populations may distinguish them as non-interbreeding. (Auth.)

5690. Collette, Bruce B. (U. S. National Mus., Washington, D. C.), Frank H. Talbot, and Richard H. Rosenblatt. 1963. THE FIRST CALIFORNIA RECORD OF SIERRA, SCOMBEROMORUS SIERRA JORDAN AND STARKS. California Fish and Game, 49(1): 53-54.

The first specimen of Scomberomorus sierra caught in United States waters is reported from La Jolla, California. It is described, illustrated, and compared with the other eastern Pacific species of Spanish mackerel, S. concolor. (Authors)

5691. Gulland, J. A. (Fish. Lab., Lowestoft, England). 1962. MANUAL OF SAMPLING METHODS FOR FISHERIES BIOLOGY. FAO Fisheries Biology Technical Paper No. 26, 79 pp.

5692. Anonymous. 1962. A PROVISIONAL LIST OF EXPERTS CONCERNED WITH DISEASES OF AQUATIC ORGANISMS AND ASSOCIATED PARASITES. FAO Fisheries Biology Technical Paper No. 11, 24 pp.

A list of 322 persons.

5693. Dees, Lola T. (U. S. Bur. of Comm. Fish., Washington, D. C.). 1962. LIST OF SPECIAL SCIENTIFIC REPORTS AND SPECIAL SCIENTIFIC REPORT--FISHERIES OF THE U. S. FISH AND WILDLIFE SERVICE. U. S. Fish and Wildlife Service Fishery Leaflet 543, 37 pp.

A list of 418 titles.

5694. Macy, Paul T. (Bur. of Comm. Fish. Biol. Lab., Seattle, Washington), and Ida K. Johnson. 1963. AQUATIC BIOLOGY AND OCEANOGRAPHY.

A SELECTED LIST OF BOOKS. U. S. Fish and Wildlife Service, Fishery Leaflet 541, 9 pp.

A list of 196 books on freshwater biology, marine biology, and oceanography.

5695. Cross, Frank B. (Mus. Nat. Hist., Univ. of Kansas, Lawrence). 1962. COLLECTING AND PRESERVING FISHES. Univ. Kans. Museum of Natural History Miscellaneous Publication No. 30, pp. 41-44.

Collecting, preserving, labeling, field notes, and handling are discussed.

5696. Anonymous. (Research Programs Section, Fish. Div., Food and Agriculture Organization of the United Nations, Rome, Italy). 1962. WORLD LIST OF PERIODICALS FOR AQUATIC SCIENCES AND FISHERIES. FAO Fisheries Biology Technical Paper No. 19, Vol. 1, 239 pp.

5697. Hora, S. L., and T. V. R. Pillay. 1962. HANDBOOK ON FISH CULTURE IN THE INDO-PACIFIC REGION. FAO Fisheries Biology Technical Paper No. 14, 204 pp.

5698. Beckman, William C. (Food & Agric. Organization, Fish. Div., Viale Terme di Caracalla, Rome, Italy). 1962. THE FRESHWATER FISHES OF SYRIA AND THEIR GENERAL BIOLOGY AND MANAGEMENT. FAO Fisheries Biology Technical Paper No. 8, 297 pp.

The first two chapters deal with the identification of fishes and descriptions of the 86 species which may possibly be found in Syrian waters. Chapters III through XIII were originally prepared at the request of the Department of Education of the Ministry of Agriculture as lectures to be given at the Agriculture Schools. However, since this did not prove feasible, the lectures are included here and the combined work may be used as a textbook at the proposed Fishery Training Center at the Kalaat el Moudik Experimental Fish Station. The last chapter of the book is a field and laboratory manual which gives the essential techniques and also has bilingual (Arabic-English) record forms. (Auth.)

5699. Clemens, Howard P. (Univ. of Oklahoma, Norman), and Kermit E. Sneed. 1962. BIOASSAY AND USE OF PITUITARY MATERIALS TO SPAWN WARM-WATER FISHES. U. S. Fish and Wildlife Service, Research Report 61, 30 pp.

By bioassay, evaluation was made of the activity and relative potency of pituitaries collected throughout the year from various species of fish. Goldfish, zebra fish, and channel catfish were the chief test species; carp, green sunfish, large-mouth bass, white crappie, and flathead catfish were used occasionally. Positive response was indicated by ovulation of eggs or by increase in seminal plasma.

In experiments to determine the species from which pituitaries can be used to spawn various species (phylogenetic specificity), 29 interspecific

and intergeneric injections and 25 interfamilial injections were successful; only 7 heteroplastic injections failed to induce ovulation or exhibited low activity. Of the 7 failures, 4 involved river carpsucker and fresh-water drum pituitaries at regular dosage levels; and the other 3 were unsuccessful attempts to spawn carp with other than homoplastic pituitaries. Specificity appears so slight that it has no practical importance in fish-cultural techniques.

Activity of pituitaries collected in various months did not vary as much as the individual variations in physical condition of the test fish. The data indicate that all the pituitaries are active in the months in which collections were made. Activity in relation to size, sex, and degree of gonadal development of the donor fish does not appear as important as implied by some previous reports in the literature.

No detrimental effects of pituitary injections have been detected in incubating and hatching the eggs, or in rearing the fingerlings, from over 200 channel catfish spawns and thousands of goldfish spawns. (Authors)

5700. Maltzeff, Eugene M., and Paul D. Zimmer (Bur. of Comm. Fish., Portland, Oregon). 1963. FALL CHINOOK SALMON RETURNS TO HATCHERIES IN THE BONNEVILLE DAM POOL AREA, 1945-60. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 437, 13 pp.

From 1938 through 1960 annual fall chinook salmon migrations over Bonneville Dam declined. During the last 16 years, numbers of young salmon released and returns of adults to hatcheries increased slightly. The annual average fall chinook salmon counts at Bonneville Dam between 1945 and 1948 were about 270,700 fish, of which 7.4 percent returned to the hatcheries. In more recent years average annual counts over Bonneville Dam dropped to about 153,000 fish; however, numbers of fish returning to hatcheries increased to about 22.1 percent of the total.

During 1945-60 approximately 104,000 fall chinook salmon (with a potential of about 247 million eggs) spawned naturally in streams on which hatcheries are located.

Hatchery records for 1945-60 indicate combined annual totals of adult fall chinook salmon returning either to the hatchery or hatchery stream were nearly 489,000 fish. For the same period, releases of fry and fingerlings from the hatcheries totaled about 572,988,000 fish.

During 1945-60 combined totals of hatchery and natural spawning fall chinook salmon were more than 529,000 fish, having a potential of approximately 1,317 million eggs. (Authors)

5701. Holmes, Robert W. (Scripps Inst. of Oceanography, Univ. of California, La Jolla). 1962. THE PREPARATION OF MARINE PHYTOPLANKTON FOR MICROSCOPIC EXAMINATION AND ENUMERATION ON MOLECULAR FILTERS. U. S. Fish and Wildlife Service, Special Scientific

Report--Fisheries No. 433, 6 pp.

The use of the molecular filter in the preparation of marine phytoplankton for microscopic examination and enumeration is discussed, and certain modifications in the method of Goldberg, Baker, and Fox (1952) are suggested.

The modified technique involves the filtration of a fixed and preserved sea-water sample. The organisms, retained on the upper surface of the filter, are washed with successively diluted volumes of sea-water, dehydrated with ethanol, stained with alcoholic Fast Green, and finally rinsed with absolute ethanol. The filter disk is cleared with beechwood creosote, xylene, or anisole and mounted directly on a microscope slide with xylene or toluene balsam under a thin cover glass.

Many nannoplankton species may be readily identified and counted on the filter disk. The method is quantitatively comparable to the Utermöhl technique. The distribution of organisms on the filter surface is nonrandom, and the organisms on the entire filter should be counted. (Auth.)

5702. Tait, Howard D., Jerry L. Hout, and Fredrik V. Thorsteinson (But. of Comm. Fish., Juneau, Alaska). 1962. AN EVALUATION OF FYKE TRAPPING AS A MEANS OF INDEXING SALMON ESCAPEMENTS IN TURBID STREAMS. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 428, 18 pp.

Test-fishing experiments conducted on the Kenai River in Alaska in 1957, 1958, and 1959 showed that large metal fyke traps were effective for obtaining indices of the escapement of red salmon into turbid streams. The traps also provided information about the age and size composition and rate of migration of red salmon runs of the Kenai River in those years.

The traps were evaluated as test-fishing gear by comparing the characteristics of the catch in them with the commercial catch and with the results of test gill netting and seining. Traps were fished at various locations to determine the influence on the catch of water depth and velocity and proximity to shore. The studies revealed that red salmon migrated chiefly along the bank in the turbid water of the Kenai River. This same migration pattern has been observed in clear-water streams.

The number of red salmon caught in the traps each year was used as an index of the escapement. The data show a significantly lower escapement occurred in 1959 than in 1957 and 1958. (Authors)

5703. Raleigh, Robert F. (U. S. Bur. of Comm. Fish., Juneau, Alaska). 1963. THE COMPOSITION, ABUNDANCE, AND DEPTH DISTRIBUTION OF THE 1957 SUMMER NET ZOOPLANKTON OF BARE LAKE, ALASKA, AFTER FERTILIZATION. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 423, 14 pp.

Bare Lake was artificially fertilized with various phosphates and sodium nitrate each summer

over a 7-year period (1950-56). During the third season of fertilization (1952), it was found that although many factors in the lake's ecology had changed, the zooplankton population had remained remarkably stable. In 1957, the zooplankton was again examined and was found to have increased at least threefold in abundance over the 1952 population. In addition, although the lake has a maximum depth of only 7.5 meters, the distribution of zooplankters by species showed a definite change with depth. (Auth.)

5704. Sheridan, William L. (Alaska Dept. of Fish and Game, Kitoi Bay Research Sta., Afognak Island). 1962. WATERFLOW THROUGH A SALMON SPAWNING RIFFLE IN SOUTHEASTERN ALASKA. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 407, 20 pp.

The following characteristics were studied in a small salmon stream in southeastern Alaska from 1956 through 1959: (1) dissolved oxygen content of ground water, (2) variation of dissolved oxygen with depth in streambed, (3) temperature of ground water, (4) extent of ground-water seepage, (5) interchange of flowing stream water and water of streambed gravels, and (6) flow of water in the gravel of streambank and gravel bar.

Ground water was generally low in dissolved oxygen content, and dissolved oxygen levels decreased with depth in streambed. Because of these and other points discussed in this paper, I conclude that the main source of intragravel water of high oxygen content is the flowing stream. (Auth.)

5705. Zimmer, Paul D., and John H. Broughton (U. S. Bur. of Comm. Fish., Portland, Oregon). 1962. ANNUAL FISH PASSAGE REPORT - ROCK ISLAND DAM, COLUMBIA RIVER, WASHINGTON, 1961. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 421, 24 pp.

Important runs of salmon and steelhead trout pass Rock Island Dam on the Columbia River.

Count of 33,067 chinook salmon in 1961 was well above the mean of 15,560 for the 28-year period 1933-60 and exceeded the 1960 count of 26,532. Sockeye salmon count of 19,233 was slightly more than one-third the 28-year mean of 53,079. Only 50 coho salmon were recorded in 1961. Greatest number of coho salmon, 229, occurred in 1947. The 7,042 steelhead trout passing Rock Island Dam in 1961 was the highest count recorded since counting began in 1933 and was more than twice the 28-year mean of 3,063. 140,173 fish other than salmon and steelhead trout passed through the fishways at Rock Island Dam in 1961. (Authors)

5706. Tait, Howard D., and James B. Kirkwood (U. S. Bur. of Comm. Fish., Juneau, Alaska). 1962. ESTIMATING ABUNDANCE OF PINK AND CHUM SALMON FRY IN PRINCE WILLIAM SOUND, 1957. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 429, 21 pp.

Salmon fry enumeration studies conducted on

eight streams in the Prince William Sound area of Alaska provided estimates of the numbers of pink and chum salmon fry produced in streams of that area in 1957. The studies were conducted to provide a basis for predicting returns of adult salmon.

A method of deriving estimates of fry production from trapping experiments and excavations of pre-emergent fry in intertidal gravel was presented.

Timing and duration of migration of chum and pink salmon fry were recorded, and recommendations were made for future fry sampling programs. (Authors)

5707. Mattson, Chester R. (U. S. Bur. of Comm. Fish., Auke Bay, Alaska). 1962. CHUM SALMON RESOURCES OF ALASKA FROM BRISTOL BAY TO POINT HOPE. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 425, 22 pp.

A literature survey was conducted to determine the importance and utilization of chum salmon, *Oncorhynchus keta*, from Bristol Bay to Point Hope, Alaska. This species is the most abundant and economically important to the welfare of the local residents within this vast area, except for the Bristol Bay area where sockeye salmon, *Oncorhynchus nerka*, far outnumber chum salmon. The Yukon River system produces the greatest number of chum salmon of all the areas covered here, with catches ranging from 500,000 to nearly 1,000,000 fish annually. The Kuskokwim River system follows, with annual catches averaging over 500,000. Ranking third in production is the Bristol Bay area where commercial catches range as high as 400,000. The rivers and streams entering Kotzebue Sound from the base of Seward Peninsula northwest to Point Hope rank fourth in importance, annual catches being estimated in excess of 264,000. (Auth.)

5708. Vaux, Walter G. (Fish. Res. Inst., Univ. of Washington, Seattle). 1962. INTERCHANGE OF STREAM AND INTRAGRAVEL WATER IN A SALMON SPAWNING RIFFLE. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 405, 11 pp.

Dissolved oxygen is supplied to intragravel water in a salmon spawning riffle through (1) interchange of water from the stream into streambed gravel, and (2) ground-water flow. The primary variables that control interchange are gradients in the stream profile, permeability of the gravel bed, and dimensions of the bed.

The delivery of dissolved oxygen to intragravel water and the way in which rate of delivery is affected by stream profile, permeability, and dimensions of the bed are explained. (Auth.)

5709. Grimås, Ulf (Inst. of Zool., Entomological Dept., Uppsala, Sweden). 1962. THE EFFECT OF INCREASED WATER LEVEL FLUCTUATION UPON THE BOTTOM FAUNA IN LAKE BLÅSJÖN, NORTHERN SWEDEN. Institute of Freshwater Research, Report No. 44, pp. 14-41.

The water level fluctuations have caused a

reduction of the bottom fauna which can be estimated at 50 percent for the 10-year period of 6 meters annual amplitude and 40 percent for the following 2-year period of 13 meters annual amplitude of the water level.

The regulation affects above all the fauna within the regulation zone, viz. the littoral, which means a general reduction of bottom areas in the lake with higher density of animals.

The regulation results in an altered balance between the different main groups of the bottom fauna. There is a decrease in the relative abundance of typical littoral forms as Gammarus lacustris, bigger insect larvae and gastropods and an increase of oligochaetes, nematodes, and pisidians. This course of development is suggested to be applicable as a short-term as well as a long-term effect of the regulation.

The changed balance between species, e.g. within the chironomids, indicates an arctification of the bottom environment and a sharpening of the oligotrophic character of the lake.

There is an altered interaction between species caused by the regulation, including amongst others an altered fish-prey relationship. There is a positive short-term effect only upon small littoral crustaceans among the fish food organisms. The long-term effect of the regulation favors (1) organisms which normally are not available as food to char and trout, (2) chironomids, which by the changed pattern of emergence seem to get less available as fish food organisms.

The elimination of the bottom vegetation and the heavy losses of organic deposits in the bottoms of the littoral owing to the eroding forces seem to be the important limiting factors dimensioning the quantity of animals. (Auth.)

5710. Lindroth, Arne. 1962. BALTIC SALMON FLUCTUATIONS 2: PORPOISE AND SALMON. Institute of Freshwater Research, Report No. 44, pp. 105-112.

Of 50 Baltic porpoise stomachs investigated 38 contained identifiable food fishes: cod, herring, sprat, transparent goby. No salmon was found.

The arguments for and against the hypothesis of Baltic salmon fluctuations as caused by porpoise predation are discussed. The hypothesis seems to lack adequate foundations. (Auth.)

5711. Lindström, Thorolf. 1962. LIFE HISTORY OF WHITEFISH YOUNG (COREGONUS) IN TWO LAKE RESERVOIRS. Institute of Freshwater Research, Report No. 44, pp. 113-144.

Hatching time, length at hatching, growth, feeding habits and habitats of whitefish young of the year in two lake reservoirs are described.

The plasticity in feeding habits is considerable and the variation which can be referred to place or diurnal rhythm is strong enough to disguise such variation as may exist between species or between the studied lakes (with different degree of lake-level regulation).

Variation between different estimates of length

at the end of the first growth year is studied. No difference in growth is as yet observed between different lakes but the growth is retarded when summer comes late.

The effect of lake-level regulations is discussed. (Auth.)

5712. Becacos, Theano (Commissione Ellenica per l'Energia Nucleare, Atene, Italy). 1962. AZIONE DI ALCUNE SOSTANZE INORGANICHE SUL'ATTIVITA' FOTOSINTETICA IN DUE LAGHI DELL'ALTA ITALIA (LAGO MAGGIORE E LAGO DI MERGOZZO). Memorie Dell'Istituto Italiano di Idrobiologia Dott. Marco de Marchi, Vol. XV, pp. 45-68.

The effects of certain inorganic salts on the photosynthetic rate in two lakes of northern Italy were studied.

For the determination of the photosynthetic rate, the C14-technique has been used.

The elements added were in the form of salts as follows: Na_2HPO_4 (P: 20 γ /l), MgSO_4 (Mg: 10 mg/l), KCl (K: 2 mg/l), FeCl_3 (Fe: 10 γ /l), MnCl_2 (Mn: 10 γ /l), $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24}$ (Mo: 10 γ /l), NaHCO_3 (C: 10 mg/l for L. Maggiore and 5 mg/l for L. Mergozzo).

In the first series of experiments, carried on in the laboratory with water from these lakes, the photosynthetic rate was measured after exposure of the samples to an artificial source of light (6 fluorescent tubes of 120 W total) for one period (6hs.) and for two periods (6+6hs.).

The mean values of the ratios between the photosynthetic rate (mg C/m³/h) and Chlorophyll a (mg/m³) is 0,6 for water from Lake Maggiore and 0,37 for water from Lake Mergozzo.

The photosynthetic rate was stimulated more by the addition of phosphate than by any other element. Phosphate caused an increase up to 70% in the Lake Mergozzo water.

Positive effects were also obtained by the addition of magnesium, while carbonate reduced the photosynthetic rate in both lakes. All the effects produced by the added elements were more pronounced in L. Mergozzo, where the salt content is lower. (Auth.)

5713. Ammosov, Yu. N. 1961. THE PLANKTON OF A TUNDRA LAKE (RASPADOCHNOE LAKE) AND ITS NUTRITIONAL SIGNIFICANCE FOR FISH AND THEIR YOUNG. (PLANKTON TUNDROVOGO OZERA RASPADOCHNOE I EGO KORMOVOE ZNACHENIE DLYA RYB I RYB'EI MOLODI.) Uchenye Zap. Yakutsk. Inst. 11. 47-52; Referat. Zhur., Biol., 1962, No. 7Zh275; Biological Abstracts, Vol. 41, No. 1, Abst. No. 442. 1963.

The lake, which was studied in early August, is located in the valley of the Lena River, in its lower course. The surface of the lake is 3 ha in area, the greatest depth 7 m, the pH 6.8, the water temperature 12° C. The dominant forms in the plankton are rotifers (20 species). Among these, the most numerous are Keratella cochlearis, Kellicottia longispina, Asplanchna priodonta, Polyarthra, and Conochilus

unicornis. Eight species of Cladocera were found, *Euryercus glacialis* predominating, and 4 species of copepods. The average number of zooplankton organisms was 103, 100/m³.

5714. Kokin, K. A. 1961. THE IMPORTANCE OF SUBMERGED MACROPHYTES AS A MEANS OF SELF-PURIFICATION OF THE MOSCOW RIVER. (O ZNACHENII POGRUZHENNYKH MAKROFITOV KAK AGENTOV SAMOOCHISHCHENIYA REKI MOSKVY.) Byull. Moskov. Obshchestva Ispytatelei Prirody Otdel. Biol. 66(5): 157-158; Referat. Zhur., Biol., 1962, No. 9V129; Biological Abstracts, Vol. 41, No. 1, Abst. No. 446. 1963.

This work was carried out with the aim of explaining the effect of submerged vegetation on the self-purification processes of the Moscow River. Observations were made both on a section free from pollution (in the region of Zvenigorod Biostation of Moscow University) and on a highly polluted section (below the city of Moscow, in the water area of the Southern Harbor. The effect of higher aquatic vegetation in the shore zone of the unpolluted section, which was overgrown with pond weeds (*Potamogeton lucens* and *P. perfoliatus*) and water-milfoil (*Myriophyllum spicatum*), showed up as a somewhat increased pH of the environment and enrichment of its O₂. The ratio of the biological consumption of O₂ (BCO) to the permanent oxidizability characterizing the quality of the dissolved organic substance, was 0.3. In the polluted section of the river the effect of the vegetation (pond weeds and water-milfoil) was more pronounced. Here there was a sharp increase in O₂ and nitrogen, a sharp decrease in ammonia N, and a considerable decrease in unstable organic substances and free carbon dioxide. The ratio of BCO to permanent oxidizability varied within extreme limits (from 1.6 to 0.4). (Auth.)

5715. Stroganov, N. S., and L. V. Kolosova (State Univ., Moscow, USSR). 1962. THE EFFECT OF NYLON PRODUCTION SEWAGE UPON AQUATIC ORGANISMS. (VLIYANIE STOCHNYKH VOD PROIZVODSTVA NEILONA NA VODNYE ORGANIZMY.) Zool. Zhur. 41(1): 24-33; Biological Abstracts, Vol. 41, No. 1, Abst. No. 452. 1963.

The main component of sewage in nylon production, AH-salt (adipic acid hexamethylenediamine) causes a diverse effect upon fish, molluscs and Cladocera. This action disturbs vital functions of the organism (feeding, growth, molt, maturation, reproduction, fecundity). Therefore the determination of the sublethal salt concentration by the survival of the adults is insufficient. On the basis of reproduction intensity and fecundity of daphnia over 7-8 generations the author determined the sublethal salt concentrations to be of 0.1 mg/l. (Authors.)

5716. Abakumov, V. A. 1960. THE CAUSES OF THE ECOLOGICAL SIMILARITY BETWEEN SALMONINAE AND PETROMYZONINAE. (O PRICHINAKH SKHODSTVA V EKOLOGII MEZHDU SALMONINAE I PETROMYZONINAE.) Nauch. Doklady Vysheish Shkoly. Biol. Nauk 3. 25-28; Referat.

Zhur., Biol., 1961, No. 4D506; Biological Abstracts, Vol. 41, No. 1, Abst. No. 454. 1963.

Lampreys and salmonids have much in common in their ecology, distribution, and patterns of periodic fluctuations in numbers. This is because the lamprey has been parasitic on salmonids for a long time, beginning with the early stages of evolution (Miocene).

5717. Bogatova, I. B. (State Sci. Res. Inst. Lake and River Fish., Velikie Luki, USSR). 1962. THE DIET OF POND-REARED YOUNG SALMON (*SALMO SALAR* L.) IN THE EARLY STAGES OF DEVELOPMENT. (PITANIE MOLODI SEMGI (*SALMO SALAR* L.) NA RANNIKH STADIYAKH RAZVITIYA PRI VYRASHCHIVANII V PRUDAKH.) Voprosy Ikhtiol. 2(1): 169-173; Biological Abstracts, Vol. 41, No. 1, Abst. No. 457. 1963.

The aim of the study was to determine which of various types of plankton and/or benthos are preferable for rearing young salmon immediately after the shift to active feeding. The preferred food for salmon 37 to 46 days after hatching, when they were about 19 mm long and weighed approximately 94 mg, proved to be benthic rather than planktonic. The stomachs of the fry contained 68.7-97.7% benthos by weight (mostly chironomid larvae); the average index of zooplankton selection was -0.59, of benthos, +0.40. Of the zooplankton organisms utilized, the larger forms were preferred by salmon fry at this age. Thus, while *Bosmina* was the predominant form of zooplankton in the pond (up to 97% by weight), only a small percentage was found in the stomachs of the salmon, and the mean selection index was negative (-0.38). On the other hand, *Daphnia pulex*, a minor constituent of the zooplankton biomass (around 1.9%), was a major contributor to the diet of the young (about 76.7% by weight) and its mean selection index was +0.91. Large chironomids constituted 32.7% of the stomach content, although the percentage of this form in the pond was greater, giving a negative selection index of -0.44. Young salmon preferred Chironomidae of the Tanytarsariae group (selection index: +0.89). The author therefore recommends that pond-reared salmon young, hatched for 37 days and weighing 94 mg or more, should be fed on chironomid larvae and other accessible benthic organisms, and on *Daphnia*. Plankton food need not be included in their diet at this stage. (C. J. H.)

5718. Chapman, Donald W. (Oregon State Univ., Corvallis). 1962. EFFECTS OF LOGGING UPON FISH RESOURCES OF THE WEST COAST. Jour. Forest. 60(8): 533-537; Biological Abstracts, Vol. 41, No. 1, Abst. No. 462. 1963.

Discussion of effects of logging on streamflow, water temperature, chemical quality and suspended sediment discharge to fish biology. Relationship of land treatment to stream energy pathways is also discussed. Current and recent research involving effects of logging on fish resources is summarized.

5719. Ioganzen, B. G. 1959. BIOLOGICAL

PRINCIPLES OF FISHERIES OF INLAND WATERS. (BIOLOGICHESKIE OSNOVY RYBNOGO KHOZYAISTVA NA VNUTRENNYKH VODOEMAKH.) Biol. Osnovy Rybn. khoz. (Biological principles of the fish economy.) Tomskii Univ.: Tomsk. 1959. p. 9-30; Referat. Zhur., Biol., 1961, No. 5D526; Biological Abstracts, Vol. 41, No. 1, Abst. No. 471. 1963.

The role of hydrobiology in the sphere of natural sciences is discussed. Fundamental measures intended to enrich the catch are cited.

5720. Ioganzen, B. G. (Tomsk State Univ., USSR). 1962. BIOLOGICAL FISHERY RESEARCH IN SIBERIA. (BIOLOGICHESKIE RYBOKHOZYAISTVENNYE ISSLEDOVANIYA V SIBIRI.) Voprosy Ikhtiol. 2(1): 3-17; Biological Abstracts, Vol. 41, No. 1, Abst. No. 472. 1963.

Siberia, with its wide variety of landscapes and water bodies, including the world's largest rivers and the deepest lake in the northern hemisphere, offers a wealth of material of interest to limnologists and hydrobiologists. Its ichthyofauna includes more than 160 species, representing a number of faunistic complexes ranging from the Arctic to the Chinese. Among the species of particular interest to biology are the Alaskan blackfish (*Dallia* sp.), inhabiting the freezing waters of Chukotka, the Mongolian *Oreoleuciscus* (Ob' River), forms unique to Lake Baikal, and peculiar fish of the Amur River. There is ample opportunity here for studying intraspecies variation in response to different ecological conditions and for observing mass spawning, fattening and winter migrations, various types of reproduction, and other interesting biological phenomena. The area also offers rich potentialities for commercial fishing. In an extensive review of the pertinent literature (198 references), the author surveys the exploration and development of Siberia's fish resources from the XVIth century to the present and then recommends measures for expanding and rationalizing their exploitation. Valuable guidance is anticipated from the new laboratories now being set up to carry on experimental studies on hydrobiology, fish physiology, and the effects of water pollution. (C. J. H.)

5721. Korzhenko, V. P. 1960. CHANGES IN THE DIGESTIVE TRACT OF CHUM SALMON DURING THE PRESPAWNING FAST. (IZMENENIE PISHCHEVARITEL'NOGO APPARATA LETNEI KETY V PERIOD PREDNERESTOVOGO GOLODANIYA.) Nauch. Doklady Vysschei Shkoly. Biol. Nauk 3. 19-32; Referat. Zhur., Biol., 1961, No. 4D438; Biological Abstracts, Vol. 41, No. 1, Abst. No. 475. 1963.

During its spawning migration, the summer chum salmon stops eating on its entrance into fresh water. There is resorption of muscle and tissues of the digestive tract. The latter becomes shorter, stomach tissues soften, intestinal walls become thin, and tissues of the digestive organs lose their fat completely. Stored nutritive substances are consumed mostly for formation of sexual products.

The degree of consumption of energy resources of the body depends on the size of the fish, degree of maturity of the sexual products, and to a lesser extent on length of migration in fresh water.

5722. Lyubimova, T. G. 1961. ROCKFISH OF THE GULF OF ALASKA. (O MORSKOM OKUNE ZALIVA ALYASKA.) Rybnoe Khoz. 9: 27-30; Referat. Zhur., Biol., 1962, No. 6I96; Biological Abstracts, Vol. 41, No. 1, Abst. No. 481. 1963.

From 1958 to 1960 significant aggregations of *Sebastes* and *Sebastolobus* were discovered while trawling near the Unimak and Shumagin Islands and Portlock Banks. Sexually mature *Sebastes alutus* with an average length of 28 to 30 cm were most often found in the catches.

5723. Mathisen, O. A. (Univ. of Washington, Seattle). 1962. COMPARATIVE AGE AND GROWTH CHARACTERISTICS OF THE SOCKEYE SALMON (*ONCORHYNCHUS NERKA* WALB) OF LAKE KURIL, KAMCHATKA, AND BRISTOL BAY, ALASKA. (SRAVITEL'NAYA KHARAKTERISTIKA VOZRASTA I ROSTA KRASNOI (*ONCORHYNCHUS NERKA* (WALB)) KURIL'SKOGO OZERA, KAMCHATKI I BRISTOL'SKOGO ZALIVA ALYASKI.) Voprosy Ikhtiol. 2(1): 42-54; Biological Abstracts, Vol. 41, No. 1, Abst. No. 486. 1963.

On the basis of scale samples and length and weight records, the author compares spawning stock density, age of migrating smolts, duration of the marine period of life before sexual maturity, and length and weight on its attainment in salmon caught in Lake Kuril, the rivers of Kamchatka, and Bristol Bay in 1951-1960. He concludes that current spawning group size is too small to exert any great effect on the age and size status of seaward migrating smolts. There was an inverse relationship between the percentage of salmon returning to spawn after a 2-year stay in the sea and the overall size of the returning stock. In Lake Kuril, the density of the spawning stock seemed to have no effect on the length and weight of 2-year-olds in the sea, but in Bristol Bay, biological indices were adversely affected by the huge aggregations of salmon observed in 1946, 1956, and 1960. Because of insufficient data, it was not possible to establish with any precision the level above which population density influences the age and growth of young in fresh water and of maturing fish in the ocean. This critical level differs, of course, for different river systems and from year to year. (C. J. H.)

5724. Mitrokhin, Yu. A. (Inst. Animal Morphol. Acad. Sci., Moscow, USSR), V. R. Protasov, and Yu. P. Altukhov. 1962. MIGRANT FISH COUNTING IN CONNECTION WITH HYDROELECTRIC CONSTRUCTIONS. (UCHET CHISLENNOSTI MIGRUYUSHCHIKH RYB V SVYAZI S GIDROSTROIETEL'STVOM.) Voprosy Ikhtiol. 2(1): 192-196; Biological Abstracts, Vol. 41, No. 1, Abst. No. 488. 1963.

In 1958, there were 50 hydroelectric units in the Soviet Union; by 1965, there will be 76, and new

stations will continue to be constructed thereafter. The construction of such installations substantially modifies the habitat of migratory, semimigratory and resident fish and often blocks access to the spawning grounds of commercially valuable species. Access can be preserved by the creation of various devices: fish ladders, fish lifts, or fish locks. Of the 50 stations in the USSR, however, only six allow the passage of fish and only three have special devices for this purpose. Using automatic fish-counting devices, the numbers of fish successfully negotiating the fish locks of one station and the fish ladders of four others were determined, as well as the number passing through several navigation locks. On the basis of these findings, conclusions are drawn as to the most suitable devices for insuring the passage of fish. Locks proved to be more easily surmounted by fish than ladders. The construction of special fish locks, of the type described and illustrated here, is therefore recommended, as is the installation of automatic devices for recording the number of fish (spawners and young) passing upstream or moving downstream. (C. J. H.)

5725. Privol'nev, T. I. 1960. THE EFFECT OF EGG SIZE ON THE GROWTH OF PARR OF SALMO SALAR L. (VLIYANIE VELICHINY IKRINOK NA ROST MOLODI LOSOSYA (SALMO SALAR L.)). Trudy Tomsk. Inst. 148: 93-102; Referat. Zhur., Biol., 1961, No. 5D450; Biological Abstracts, Vol. 41, No. 1, Abst. No. 495. 1963.

Yolk consumption and the growth of the embryonic body proceed identically for salmon from small or large ova. Dissimilarities relate only to the quantity of yolk, which is greater in embryos from large eggs, and carry over to the post-embryonic growth period. Larval stages from large eggs have larger quantities of yolk, but do not differ in weight from larval stages developing from small eggs. This circumstance affords the former a longer endogenous feeding period and later transition to active feeding. The variability in the time of larval transition to active feeding broadens the scope of food opportunities for the parr and improves their percentage survival. Embryos from large or small females having eggs of similar size, do not differ in the size and quantity of the yolk.

5726. Zhuravel', P. A. 1961. AN EXPERIMENT IN THE ENRICHMENT OF THE FOOD FAUNA FOR FISH IN THE SMALL RIVERS OF THE STEPPE ZONE OF THE UKRAINE AND IN THE RESERVOIRS BEING CREATED IN THEM. (OPYT OBOGASHCHENIYA KORMOVOI FAUNY DLYA RYB V MAL'YKH REKAKH STEPNOI ZONY UKRAINY I VOZNIKAYUSHCHIKH NA NIKH VODOKHRANILISHCHAKH.) Akad. Nauk SSSR: Moscow-Leningrad. p. 346-350; Referat. Zhur., Biol., 1962, No. 7Zh290; Biological Abstracts, Vol. 41, No. 1, Abst. No. 506. 1963.

The bottom fauna of the reservoirs investigated consisted chiefly of secondary water animals. Hence their food base is meager and quite insufficient; it can be significantly enriched by introducing

representatives of the fauna of the marsh complex. In recently filled steppe reservoirs, the Vasil'evskoe (120 ha) and the Koristovskoe (300 ha), Mesomysis kowalewskyi, Limnomysis benedeni, and gammarids have been acclimatized. The animals, caught in the Dneprovskoe Reservoir and in other water bodies, were introduced into the respective rivers before the reservoirs were created. Introduced into the Makortovskoe Reservoir (2000 ha), in addition to the crustaceans mentioned, were the mollusks Viviparus viviparus and Lithoglyphus naticoides; and in the Bakhchisariskoe Reservoir (Crimean Peninsula), Sphaerium as well. Crustaceans have started to become acclimatized particularly well.

5727. Ridgway, George J. (U. S. Bur. of Comm. Fish., Seattle, Washington). 1962. THE APPLICATION OF SOME SPECIAL IMMUNOLOGICAL METHODS TO MARINE POPULATION PROBLEMS. Amer. Nat. 96(889): 219-224; Biological Abstracts, Vol. 41, No. 1, Abst. No. 4170. 1963.

The methods of immunodiffusion and immunoelectrophoresis and their application to detection of intraspecies differences in serum antigens of red salmon (Oncorhynchus nerka) are discussed. Evidence for the production of hemagglutinating antibodies in the sablefish (Anoplopoma fimbria) at temperatures below 10° is presented. Isoimmune sera produced in rainbow trout (Salmo gairdnerii) were used to detect blood group differences in red salmon. (Auth.)

5728. Sprague, Lucian M. (U. S. Bur. of Comm. Fish., Honolulu, Hawaii), and J. Richard Holloway. 1962. STUDIES OF THE ERYTHROCYTE ANTIGENS OF THE SKIPJACK TUNA (KATSUWONUS PELAMIS). Amer. Nat. 96(889): 233-238; Biological Abstracts, Vol. 41, No. 1, Abst. No. 4173. 1963.

The erythrocyte antigens of Katsuwonus pelamis are organized in several blood group systems. The B-system characterized by patterns formed by various combinations of 3 blood factors E, K₁, and K₂, and their absence, and the C-system by the blood factor C₃ and its absence are the most important of these systems. Studies on approximately 1000 Katsuwonus pelamis were undertaken in order to find means whereby reproductively isolated stocks of tuna found in the Central Pacific Ocean could be recognized and described. A study of the relative proportion of phenotypes in the C-system and B-system was carried out. The relative proportions of individuals in the B-system in samples from Hawaii were distinct from those of other areas as were those from the Margueas. Samples from Tuamotu and the Society Islands were distinct from those from the other areas, but were not distinguishable from each other. It is hypothesized that at least 2 and very probably 3 reproductively isolated populations are represented by the samples collected from these island areas. The relative frequencies of C-system phenotypes did not show significant association with area of capture. (Authors)

5729. Suzuki, Akimi (Nankai Reg. Fish. Res. Lab., Kochi, Japan). 1962. ON THE BLOOD TYPES OF YELLOWFIN AND BIGEYE TUNA. Amer. Nat. 96(889): 239-246; Biological Abstracts, Vol. 41, No. 1, Abst. No. 4175. 1963.

Investigation of erythrocyte antigens of bigeye and yellowfin tunas by means of immune and normal sera have shown a variety of antigenic differences. In the yellowfin tuna, an antigen similar to Tg2 of albacore was detected by means of absorbed rabbit antisera, and at least 2 kinds of antigen X were detected using the absorbed normal sera of marlin. In the case of bigeye tuna, 3 antigens were recognized; 2 of them were very similar to Tg1 and Tg2 of albacore. The 3rd antigen Tg3 (bigeye) also was found to have a very similar counterpart in albacore. A marked difference in frequency of this antigen was shown between the albacore from the Atlantic Ocean, and those from the Indian and Pacific Oceans. This suggests that the albacore of the Atlantic and Indian Oceans do not interbreed with each other to any great degree. (Auth.)

5730. Walters, Vladimir (Univ. of California, Los Angeles). 1962. BODY FORM AND SWIMMING PERFORMANCE IN THE SCOMBROID FISHES. Amer. Zool. 2(2): 143-149; Biological Abstracts, Vol. 41, No. 1, Abst. No. 4176. 1963.

The Reynolds Numbers are conservatively estimated to range from 3.7×10^5 to 7.3×10^7 for actively swimming scombroids and thus their shape and body structure are postulated to reflect the interactions between the fish and its immediate environment. The immediate environment is the boundary layer, the mechanics of which governs swimming performance. Scombroids are compared with hydrofoils having movable drag reduction devices. The head and gill covers constitute a compensating leading-edge slat, and delay boundary layer separation. The finlets control cross-flow and prevent separation in a manner similar to the slotted wing tips of birds. The keeled peduncle serves as a low drag coupling for the caudal fin. Cross-flow and separation are reduced by the high aspect ratio of the caudal fin, and also by the caudal keels which act both as boundary layer fences and boundary layer energizers. The Scombridae have a Joukovsky profile. Since they operate below $R = 2 \times 10^6$ they have no boundary layer separation problem, and they show no other apparent mechanisms to reduce form drag. The corselet of the Cybiidae, Thunnidae, and Katsuwonidae may reduce form drag by making the boundary layer turbulent, thus delaying separation in their R range of 3.7×10^5 to 7.3×10^7 . The Cybiidae have a laminar profile and have altered their thickness ratio to reduce form drag. The thunnids and katsuwonids have not done this, and they may reduce form drag by thermally energizing the turbulent boundary layer between the corselet and the caudal fin. The istiophorids and xiphiids apparently have a reversed pressure gradient and fully turbulent boundary layer between

bill tip and gill covers. This makes it difficult to say anything about how the rest of the body may perform in swimming. Owing to differences in caudal fin and peduncle structure, the families are presumed to have different swimming performances. (Auth.)

5731. Marti, Yu. Yu. 1961. FISHING AND SOME PROBLEMS OF OCEANOGRAPHY. (RYBOLOVSTVO I NEKOTORYE VOPROSY OKEANOLOGII.) Okeanologiya 1(5): 779-790; Referat. Zhur., Biol., 1962, No. 8196; Biological Abstracts, Vol. 41, No. 2, Abst. No. 4794. 1963.

In the life of fishes, a very important role is played by the distribution by ocean currents of the developing roe, fingerlings, and young fishes. The drifting of the young is ended by the return migration against the currents to the spawning places. The spawning migrations of adult fishes are also related to the ocean currents. The makeup of the mass of water and the nature of the ocean currents determine the degree of localization of the species. Knowledge of the structure and mobility of the water masses makes it possible to predict specific biological characteristics of many species of fishes in the different areas where they exist. The relation of the fishes to the water masses changes, depending on the physiological condition of the fishes. Prolonged changes in hydrological conditions cause changes in the habitat and extent of the seaward migrations of fishes, but a contraction of the habitats of cod in the Barents Sea and of the Atlantic-Scandinavian herring in the waters of Norway and Greenland is associated with an abrupt decrease in the numbers of these species. All the important fishing areas in the world coincide with areas having an abundant supply of biogenic elements. The fishing productivity of a body of water is not limited by its nutritional resources, but by the degree to which they are used by fishes. The effective use of the feeding potentialities can be realized only when there is a large population of fishes to be fed and their food requirements are varied. The amount of organic matter deposited in the ocean by living organisms is very large.

5732. Gonzalez Guerrero, Pedro. 1961. THE SLOW DYING-OUT OF THE ALGAE IN THE RIVER BED OF THE PO. (LA LENTA NECROSIS FICICA EN EL CAUCE DEL PO.) Bol. Real Soc. Espanola Hist. Nat. Secc. Biol. 59(1): 43-54; Biological Abstracts, Vol. 41, No. 2, Abst. No. 4820. 1963.

This is a general discussion of the effect on plant life, particularly algae, of the pollution of the waters of the river, in recent years. The types of habitat available, and composition of the surviving plant communities in such habitats, are discussed. (A. K. W.)

5733. Morokhovets, L. V. 1959. THE PHYTOPLANKTON OF THE KUIBYSHEVSK RESERVOIR IN THE YEAR IT WAS FILLED. (FITOPLANKTON KUIBYSHEVSKOGO VODOKHRANILISHCHA V GOD EGO ZAPOLNENIYA.) Trudy Inst. Biol.

Vodokhranilishch. Akad. Nauk SSSR 2(5): 22-30; Referat. Zhur., Biol., 1961, No. 1V46; Biological Abstracts, Vol. 41, No. 2, Abst. No. 4824. 1963.

Among the materials gathered from May to October of 1956 were 170 taxa of algae: of these 68 were green algae, 41 Diatomaceae, 20 blue-green algae, and 17 euglenoid algae (other groups were represented by only a few species). The Diatomaceae and the blue-green algae predominate in density. The spp. composition is more varied in the upper part of the reservoir than in the lower part close to the dam. It was observed that closer to the dam the density and biomass of the Diatomaceae and green algae decreased, while those of the blue-green algae increased. The average density of the phytoplankton ranges from 331,000 to 200,639,000 cells/l. The maximum biomass of the phytoplankton in the upper part of the reservoir was 5,6000 mg/l, in the lower part it was 1,500 mg/l, and in the part closest to the dam it was 44,300 mg/l in August (the period of blooming of the blue-green algae). The density of the phytoplankton in the Kuibyshevsk Reservoir is greater than it is in the Dneprovsk Reservoir, somewhat less than in the Tsimlyansk Reservoir, and greater than in the Volga River before its regulation. Vertical stratification of the phytoplankton is observed only in the deepest part of the lower end of the reservoir where there is almost no current. Diatomaceae predominate in the spring, Diatomaceae, blue-green algae, and Protococcaceae predominate in the summer, and Diatomaceae and Protococcaceae predominate in the fall.

5734. Salmanov, M. A., and Yu. I. Sorokin (Inst. Biol. Reservoirs, Acad. Sci., USSR, Borok). 1962. PRIMARY PRODUCTION OF THE KUIBYSHEV RESERVOIR. (PERVICHNAYA PRODUKTSIYA KUIBYSHEVSKOGO VODOKHRANILISHCHA.) Izvest. Akad. Nauk SSSR. Ser. Biol. 4. 603-613; Biological Abstracts, Vol. 41, No. 2, Abst. No. 4828. 1963.

The total primary production of organic matter during the entire vegetation period amounted to 1.6 million tons of dry organic matter containing 50% carbon. On a basis of 1 m³ and 1 m² reservoir surface it constituted 356 g/m² and 37.6 g/m³ glucose respectively. When computed per unit area it is 3 times as much as that of the Rybinsk Reservoir and 2 times as much as that of the Gorky Reservoir. Most productive is the Cheremshan Bay where the primary production per 1 m² amounts to 620 g on a glucose basis. The total value of destruction of organic matter is 2.2 times as much as the primary production. This is due to a violent decomposition of the allochthonous organic matter in the water column. The maximum rate of primary production is noted during intense blooming in blue-green algae, viz. in July and August. The principal zone of phytoplankton photosynthesis in the reservoir is the 0-2 m layer. (Auth.)

5735. Winner, R. W., R. L. Strecker, and E. M. Ingersoll (Miami Univ., Oxford, Ohio). 1962.

SOME PHYSICAL AND CHEMICAL CHARACTERISTICS OF ACTON LAKE, OHIO. Ohio Jour. Sci. 62(1): 55-61; Biological Abstracts, Vol. 41, No. 2, Abst. No. 4832. 1963.

This paper describes certain physical and chemical characteristics of Acton Lake, Ohio, on the basis of data collected during 1959 and 1960. The lake exhibited strong thermal and chemical stratification which began to develop in early June and was intensified throughout July, August, and September. During the height of summer stagnation, water temperatures within the thermocline frequently decreased by 3° to 5° F per foot of increasing depth and multiple thermoclines were commonly present. Minimum Secchi disc transparencies occurred during late summer and were probably a consequence of large phytoplankton populations, as evidenced by supersaturated concentrations of oxygen in the epilimnion during this period. Oxygen depletion began to develop in the deeper water concurrently with thermal stratification and there was less than one ppm of dissolved oxygen at depths of 20 ft or more from mid-June until the fall turnover in October. Total alkalinity varied from 117 to 267 ppm, with minimum values occurring at the surface in early September and maximum values at a depth of 30 ft in mid-October. Free carbon dioxide accumulated in the deeper water during the stagnation period, with concentrations exceeding 30 ppm at a depth of 30 ft in September. The odor of hydrogen sulfide was detectable in water from depths of 30 ft by late July, and from depths of 17 ft by early September. The pH varied from 9.0 to 7.2, with maximum values at the surface and minimum values at a depth of 30 ft in early September. The sharp thermal stratification is apparently a consequence of the protected position of the lake relative to prevailing westerly and southwesterly winds of the summer period. Thermal stratification, in turn, is a primary factor contributing to the well-developed chemical stratification. The rapid depletion of oxygen and the accumulation of high concentrations of free carbon dioxide and bicarbonates, associated with the presence of hydrogen sulfide, in the deeper water must be due to intense biological activity and indicates a highly eutrophic body of water. (Authors)

5736. Lange, J., and O. Ljungberg (Statens Veterinärmedicinska Anstalt, Stockholm, Sweden). 1962. OUTBREAKS OF FISH FURUNCULOSIS IN SALMONIDS IN SWEDEN 1951-1960. (UTBREDNINGEN AV FURUNKULOS HOS FISK I SVERIGE UNDER AREN 1951-1960.) Nordisk Veterinärmed. 14(3): 177-191; Biological Abstracts, Vol. 41, No. 2, Abst. No. 4858. 1963.

Furunculosis in fish (infection with Aeromonas salmonicida) occurred for the first time in Sweden in 1951. During 1951-1960 the disease has been observed in some ten rearing stations for salmonid fish, situated along the watersheds of four Swedish rivers - Dalälven (D), Idalsälven (I), Angermanälvan (A) and Lule älven (L). Further outbreaks of furunculosis have occurred in impoundments for

breeding salmonids at three of the above rivers. On some occasions the disease has been spread from one fish rearing station to another by the exchange of live fish. Furunculosis has not been observed in wild salmon or trout in Sweden. The observations, which have been made in connection with spontaneous outbreaks of furunculosis during the period 1951-1960, are not considered sufficient evidence to draw the conclusion that *Aeromonas salmonicida* is an ubiquitous bacterium in Swedish waters. (Authors)

5737. Stsukina, I. 1961. MIGRATIONS OF THE BALTIC COD. (LAANEMERE TURSK RANDAB.) Eesti Loodus 6. 361-363; Biological Abstracts, Vol. 41, No. 2, Abst. No. 4872. 1963.

The results are described of cod marking undertaken in the northwestern part of the Baltic Sea in September 1957. The tagged fishes were recovered over a period of several years in the southern and western parts of the Baltic. The marking revealed an extension of the migration routes of the cod. This extension can be accounted for by changes in the hydrological conditions of the Baltic. (Auth.)

5738. Khlebovich, V. V. (Zool. Inst., Acad. Sci. SSSR, Leningrad). 1962. SPECIFIC FEATURES OF THE AQUATIC FAUNA COMPOSITION IN RELATION TO THE SALINITY OF THE WATER. (OSOBENNOSTI SOSTAVA VODNOI FAUNY V ZAVISIMOSTI OT SOLENOSTI SREDY.) Zhur. Obshchei. Biol. 23(2): 90-97; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9032. 1963.

An attempt is made to extend the well-known Remane's curve to the region of high salinity. The allochthonous fauna composition of hypersaline lagoons is explained by the geological ephemerality of hypersaline waterbodies. The fact that the fauna of hypersaline lagoons consists mainly of elements of brackish or fresh-water, by their origin, is explained by the development of osmoregulatory mechanisms, functioning in both directions in some fresh and brackish water species. The fauna of hypersaline lagoons is being divided into the hypersaline one (*sensu stricto*), consisting chiefly of marine euryhaline and brackish water elements, and into ultrahaline one (*sensu stricto*) consisting chiefly of species brackish and fresh-water by their origin. These faunas are separated by the salinities of some 75-80 ‰. (Auth.)

5739. Abdurakhmanov, Yu. A., and A. G. Kasymov (Zool. Inst., Acad. Sci. Azerbaidzhan SSR, Baku). 1962. THE FOOD RELATIONSHIPS OF FISH IN THE BASIN OF THE KURA RIVER. (PISHCHEVYE OTNOSHENIYA RYB BASSEINA REKI KURY.) Zhur. 41(6): 901-904; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9056. 1963.

Among 50 fish species dwelling in the Kura River basin there are predators (sheat-fish, zander, pike, perch and *Aspius taeniatus*), carnivorous fishes (roach, gudgeon, barbel, loach, bullheads,

Blicca bjoerkna, *Alburnoides bipunctatus eichwaldi* and others), and herbivorous fishes (*Varicorhinus capoeta*). A very feeble food selectivity and an easy transition from one food to another are noticed. The bulk of benthos feeding fishes in the Kura River have similar food spectra, feeding exclusively on epi- and in-fauna. Plankton feeding fishes are absent from the Kura which is very poor in both phyto- and zooplankton. (Auth.)

5740. Armitage, Kenneth B. (Univ. of Kansas, Lawrence). 1962. A COMPARATIVE LIMNOLOGICAL SURVEY OF LEAVENWORTH COUNTY AND NEMAHA COUNTY STATE LAKES, KANSAS. Univ. Kansas Sci. Bull. 43(10): 611-644; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9057. 1963.

A limnological survey was made of Leavenworth County State Lake and Nemaha County State Lake, Kansas, between November 7, 1957, and May 29, 1958. Nemaha County State Lake is a third-class lake and Leavenworth County State Lake is a second-class lake. Chloride, bicarbonate and sulfate were higher than the average for temperate lakes not draining sediments particularly high in one of these ions. There was enrichment of phosphate and sulfate in both lakes following summer storms. The lakes were frequently supersaturated with oxygen in the trophogenic zones. Concentrations of carbon dioxide were higher than those of atmospheric equilibrium during most of the period of study. Chemical and planktonic changes in the hypolimnion of Leavenworth County State Lake were typical for a second-class lake. The average standing crop, dry weight, of net plankton was 55.4 kg/ha and 657 mg/M³ for Leavenworth County State Lake and 48.8 kg/ha and 1626 mg/M³ for Nemaha County State Lake. On the basis of standing crop, both lakes are highly eutrophic. The chief differences between the lakes seem to be in the richer nutrient level of Nemaha County State Lake and the deeper trophogenic zone of Leavenworth County State Lake. (Auth.)

5741. Brahins'kyi, L. P., and L. P. Rotov's'ka. 1960. EFFECT OF HERBICIDE 2,4-D ON POND INVERTEBRATES. (VPLYV HERBITSYDU 2,4-D NA STAVKOVYKH BEZKHREBETNYKH.) Dopovidi Akad. Nauk Ukrain. R.S.R. 4. 529-531; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9058. 1963.

The effects of 2,4-D on representatives of pond zooplankton and zoobenthos were investigated in laboratory and field tests. 2,4-D is toxic for *Bosmina longirostris* at concentrations of less than 1 mg/l, while the young of Cyclopidae are relatively insensitive to it. When the dry bed of a drained pond was treated with 2,4-D, no toxic effects were noted in the invertebrate population which developed after refilling of the ponds. Locations where 2,4-D was introduced show a marked increase in the population of planktonic Cyclopidae (in the naupliar stage) and larvae of Tendipedidae (as compared to similar pond areas not treated with). All in all, 2,4-D concentrations required for control of higher vegetation are not toxic for the hydrofauna under

field conditions and are similar in their effects to organic fertilizers.

5742. Elster, Hans-Joachim. 1962. LAKE TYPES, FLOWING WATER TYPES AND THE SAPROBIC SYSTEM. (SEETYPEN, FLIESSGEWASSTERTYPEN UND SAPROBIENSYSTEM.) Internatl. Rev. Gesamten Hydrobiol. 47(2): 211-218; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9059. 1963.

The trophic system can be applied equally well to the description both of standing and of flowing waters. The trophic system is based upon the supply of nutrients in the water. Although trophic levels determine the presence of certain organisms and of characteristic biocoenoses, investigations of the ecological spectrum of individual species are very scarce. The saprobic system is based on the load of organic matter carried by the water. "Saprotrophy" is essentially an ultraeutrophy, and fits in well with the trophic system. For particular purposes, the entire saprobic system is useful, but frequently it has been applied in situations where it has no significance, thus leading to absurdity. The system can rightly be applied only to running water and never to standing water. Furthermore, it cannot be rigidly defined. There are no indicators of organic pollution, but only for the ecological conditions brought forth by effluents. The so-called indicators also are to be encountered in natural waters that are devoid of artificial organic pollution. At the lower levels of the saprobic system, there are no indicators other than species indicating trophic states. (C. C. D.)

5743. Kaftannikova, O. G. 1961. THE RATE OF PHOTOSYNTHESIS IN THE OVERGROWTHS AND THE MICROPHYTOBENTHOS OF THE MOSCOW RIVER. (INTENSIVNOST' FOTOSINTEZA OBRASTENII I MIKROFITOBENTOSA R. MOSKVY.) V Sb.: Biotsenozy Obrastanii v Kachestve Biopoglotitelya, Moskva, Moskov. Univ. 221-234; Referat. Zhur., Biol., 1962, No. 10V25; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9062. 1963.

After exposure in the Moscow River, slides overgrown with periphyton were placed in light and dark flasks with ground stoppers and again exposed at the same depth for 1-2 days to determine the rate of photosynthesis and primary production (under summer and winter conditions). It was found that the photosynthetic activity continues throughout the year, while the rate of photosynthesis changes as a result of a number of factors. The overgrowth rate reaches a peak during the flood period.

5744. Polyvanna, M. F. 1958. RESULTS OF HYDROBIOLOGICAL STUDIES OF RESERVOIRS IN THE STALINSKAYA OBLAST' OF THE UKRAINIAN SSR. I. ZOOPLANKTON. (REZUL'TATY HIDROBIOLOHICHNYKH DOSLIDZHEN' VODOSKHOVYSHCH STALINS'KOYI OBLASTI URSR. I. ZOOPLANKTON.) Visnyk Kyyivs'k. Univ. Ser. Biol. 1(2): 137-145; Referat. Zhur., Biol., 1961, No. 6D481; Biological Abstracts, Vol. 41, No. 3,

Abst. No. 9066. 1963.

Studies of zooplankton in 8 small reservoirs located on minor rivers were carried out from 1953 to 1956. The reservoirs were designated to supply drinking water, as well as for technological purposes. The reservoirs were divisible into 2 morphometric types: river bed type, elongated, with sizable deep spots and shallow reservoirs of irregular shape. Water in the drinking water reservoirs is vitriolized to prevent "flowering" of Cyanophyceae. The zooplankton is quantitatively rich; 47 species of animals were noted in it, with Crustacea predominating. Seasonal dynamics of the zooplankton biomass are traced. Seasonal variations in the population numbers and biomass of zooplankton are affected by water temperature, the provision of food for the zooplankton and the level of development of cyanophycean algae which exert a negative effect due to their toxicity. Preventive vitrolation is recommended to prevent "flowering". It is also necessary to increase the population of planktophagous fishes.

5745. Bakshtanskii, E. L. 1961. THE ROLE OF FEEDING AND OF WARMING OF THE WATER IN THE ARTIFICIAL REARING OF SALMON ABOVE THE ARCTIC CIRCLE. (ROL' KORMLENIYA I PODOGREVA VODY PRI ISKUSSTVENNOM VYRASHCHIVANII LOSOSEI V ZAPOLYAR'E.) Rybnoe Khoz. 10. 15-18; Referat. Zhur., Biol., 1962; No. 9I78; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9072. 1963.

The use of warmed water in salmon-raising establishments above the Arctic Circle, and the construction of such establishments at springs furnishing water with higher winter temperatures, makes it possible to shorten the incubation period and prolong the growing period. It also makes possible feeding the young at optimal water temperatures, and to deliver pink salmon fingerlings weighing 220-400 mg and chum salmon weighing 370 mg.

5746. Berlyand, T. B. 1961. THE THEORETICAL BASIS OF THE FISHING INDUSTRY AS A DIVISION OF BIOTECHNICS AND ITS POSITION IN THE SCIENTIFIC SYSTEM IN RELATION TO THE PROBLEM OF HYDROELECTRICAL CONSTRUCTION. (TEORIYA RYBNOGO KHOZYAISTVA KAK RAZDEL BIOTEKHNIKI I EE POLOZHENIE V SISTEME NAUK V SVYAZI S PROBLEMOI GIDROSTROITEL'STVA.) Byull. Nauch.-Tekh. Inform. Vsesoyuz. Proektno-Izyskat. Nauch.-Issledovatel. Inst. "Gidroproekt." 13. 24-33; Referat. Zhur., Biol., 1962, No. 9I70; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9074. 1963.

Investigations in the field of fisheries are a division of science which should be called "General and special theories of the fishing industry." The basic tasks of this science are to work-out questions of the rapid exploitation by the fishing industry of natural resources, and the purposeful formation and wide production of the raw material base of bodies of water. To this end it is necessary to

establish regular patterns for determining the size of catches, to divide up the fishing industry geographically, and to study all the questions related to measures for active regulation and wide production of fish. For the successful development of the theory of the fishing industry, there must be rational organization of the fishing industry itself and of all the fishing in the USSR. Consideration must be given here to the nature of the fishing and the conditions under which the fish are produced in all fishing areas.

5747. Koshelev, B. V. 1961. CHANGE OF THE SEXUAL CYCLE OF FISHES HAVING A SINGLE SPAWNING TIME (EACH YEAR) ASSOCIATED WITH CHANGED CONDITIONS OF EXISTENCE. (IZMENENIE POLOVYKH TSIKLOV U RYB S EDINOVREMENNIM IKROMETANIEM V SVYAZI S IZMENENIEM USLOVII SUSHCHESTVOVANIYA.) Voprosy Ikhtiol. 1(4): 716-724; Referat. Zhur., Biol., 1962, No. 9154; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9095. 1963.

Histological examination of the seasonal development of the sexual glands of the bream, roach, perch, ruff, and pike of Lake Glubokoe was made and ecological observations were made on the biology of reproduction of these species of fishes in the lake. The rate and nature of the growth of the oocytes determining the unique sexual cycles of the fish changed substantially, being an adaptation to changed living conditions. The change in maturation of the sexual glands differs with synchronous and asynchronous growth of the oocytes. In the ruff (an example of fishes with asynchronous growth of the oocytes), the resorptive processes in the ovaries of females which have spawned do not cause noticeable changes in the growth rate of the oocytes of subsequent generations. Sometimes resorption of the discharged follicles and of oocytes which have not ovulated and the growth of a new generation all proceed simultaneously. In the perch (an example of fishes with typical frontal growth of oocytes) there is a single discharge of roe, leaving in the ovaries only oocytes with slight growth and empty follicles which have been subjected to resorption. The growth of a new generation is observed only after completion of all the resorptive processes in the ovary. If the transitional (sic) (VI-II) stage of maturity of the sexual glands is prolonged and empty follicles in the phase of overgrowth are detectable for long periods, then growth of the oocytes of a new generation is not observed. Delay in the resorptive processes is evidently related to a physiological condition of the body and is caused primarily by inadequate feeding during the period. In the absence of causative conditions the transitional stage of maturity is prolonged, the growth of the oocytes of the new generation is delayed, and this leads to skipping of the next spawning period.

5748. Savenko, I. M., L. V. Vasil'ev, and R. L. Krevchenko. 1961. CREATING NORMAL CONDITIONS FOR THE TRANSIT OF YOUNG FISH IN THE AREA OF THE DISCHARGE INSTALLATIONS

OF THE STATE REGIONAL ELECTRIC POWER STATION ON THE KURA RIVER. (K VOPROSU O SOZDANII NORMAL'NYKH USLOVII DLYA PROKHODA MAL'KOV V RAIONE SBROSNYKH SOORUZHENII GRES NA KURE.) Trudy Novochoerkasskogo Inzhenerno Meliorativnogo Inst. 7: 170-173; Referat. Zhur., Biol., 1962, No. 9171; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9113. 1963.

The study was made under laboratory conditions with a scale model having different combinations of discharge tubes and different directions of discharge into the river. It was noted that the general direction of the surface currents of the water discharged was from the orifice to the right bank. The deep currents in the discharge area almost coincided with the direction of flow of the river. Above and below the orifice persistent whirlpools were formed, while between them there were areas of strong, unstable currents. These current conditions created an unfavorable temperature barrier for the fingerlings. To get rid of it a floating protective wall was set up in front of the discharge area, consisting of a wooden wall which did not reach to the bottom of the river. The presence of this wall caused intensive mixing of the warm water with that of the river in a limited area. The water discharged went under the wall and in the deep currents it went toward the opposite bank. The installation of the wall destroyed the temperature barrier in the discharge area, creating favorable conditions for the transit of the fingerlings.

5749. Svetovidova, A. A. 1961. DATA ON THE AGE AND GROWTH RATE OF THE CHUM SALMON, ONCORHYNCHUS KETA (WALBAUM), OF THE MY RIVER. (MATERIALY PO VOZRASTU I TEMPU ROSTA LETNEI KETY (ONCORHYNCHUS KETA (WALBAUM)) REKI MY.) Nauch. Doklady Vysshoi Shkoly Biol. Nauk 1. 29-32; Referat. Zhur., Biol., 1962, No. 9149; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9117. 1963.

On the My River in 1955 the average size of the females (54.7 cm) was less than that of the males (58.0 cm). Changes in the size of 4-year-old fish were followed during the spawning migration. The average size of the males changed from 50.8 cm to 59.1, that of the females from 53.1 to 56.8. The smallest fish came at the end of the spawning migration. Growth takes place unevenly in the My River chums while in the sea. They grow best in the first year in the sea. Fish with delayed growth enter the river last.

5750. Yudanov, K. I. 1962. QUANTITATIVE ASSESSMENT OF COD CONCENTRATIONS IN THE BALTIC USING SONAR. (KOLICHESTVENNAYA OTSENKA SKOPLENII BALTIISKOI TRESKI S POMOSHCH'YU EKHOLOTA.) Rybnoe Khoz. 1. 26-32; Biological Abstracts, Vol. 41, No. 3, Abst. No. 9120. 1963.

Methods were developed for making quantitative estimates of the size of Baltic cod groups with sonar equipment. Formulas are given for interpreting sonar readings in terms of number of fish per square

meter. Relatively precise estimates are possible when the population is homogeneous. Sonar methods may be used to follow fish migrations and to study changes in fish populations effected by hydrological and biological factors. The accumulation and systematization of this data is of commercial interest. (M. J. H.)

5751. McDonald, S. (Canada Dept. Agric. Res. Sta., Lethbridge, Alberta, Canada). 1962. RAPID DETECTION OF CHLORINATED HYDROCARBON INSECTICIDES IN AQUEOUS SUSPENSION WITH GAMMARUS LACUSTRIS LACUSTRIS (SARS.). Canadian Jour. Zool. 40(5): 719-723; Biological Abstracts, Vol. 41, No. 3, Abst. No. 12359. 1963.

A fresh-water shrimp Gammarus lacustris lacustris (Sars.), common in prairie fresh-water lakes and ponds and readily collected and cultured, was found to be a sensitive bioassay organism for the rapid detection of chlorinated hydrocarbon insecticides in aqueous suspension. This shrimp was most sensitive to lindane and endrin and levels as low as 0.01 p. p. m. can be detected in 54 and 175 minutes, respectively. (Auth.)

5752. Branson, Branley A. (Kansas State Coll. Pittsburg, Pittsburg, Kansas). 1962. COMPARATIVE CEPHALIC AND APPENDICULAR OSTEOLOGY OF THE FISH FAMILY CATOSTOMIDAE. PART I, CYCLOPTERUS ELONGATUS (LESUEUR). South-western Nat. 7(2): 81-153; Biological Abstracts, Vol. 41, No. 3, Abst. No. 12658. 1963.

This is the first paper in a series which undertakes a detailed analysis of the cephalic and appendicular skeletal components of the primarily American suckers. The skull of the blue sucker is wholly dissimilar to that of any other catostomid. It is very compact and small in relation to the rest of the body. Its various articulations, sutures, cartilaginous elements, tendons, ligaments, muscle origins and insertions and nerve foramina are delineated. All of the elements usually present in minnows and other suckers are present but most are peculiar to this genus. Numerous tendons and ligaments, hereto unknown, are described; many of them are thought to be homologous to those in other fishes with protractile mouths. The catostomid branchial apparatus is highly modified for food concentration. Every element is illustrated. (Auth.)

5753. Chestnoi, V. N. 1961. THE MAXIMUM SPEEDS OF MOVEMENT OF FISHES. (MAKSI-MAL'NYE SKOROSTI DVIZHENIYA RYB.) Rybnoe Khoz. 9. 22-27; Referat. Zhur., Biol., 1962, No. 8145; Biological Abstracts, Vol. 41, No. 3, Abst. No. 12659. 1963.

The movement of fishes at maximum speeds is accompanied by characteristic jumps. Momentary delays are necessary before the resumption of the laminar flow to which the bodies of fishes are adapted. Since fishes often need to use maximum speed, this has been a factor in the change of their shape during evolutionary development.

The maximum speed is determined by the formula $v = ml^{1/3}$, in which l is the characteristic length of the fish in cm and m is a species coefficient which experiments have shown to have a value between 16 and 171. Maximum speed in cm/sec varies from 40 (in the sea bass) to 1010 (in the blue shark).

5754. Patrick, Ruth. 1962. A STUDY OF THE NUMBERS AND KINDS OF SPECIES FOUND IN RIVERS IN EASTERN UNITED STATES. Proc. Acad. Nat. Sci. Philadelphia 113(10): 215-258; Biological Abstracts, Vol. 41, No. 4, Abst. No. 13097. 1963.

The number of taxa of a major group of organisms usually does not differ more than 33% from the mean for that group. Perhaps the reason for this similarity of numbers of taxa of a group of organisms in these areas of natural streams is because there are a finite and similar number of habitats or niches for species occupancy. The numbers of taxa which are available to live in the area under consideration are greater than the number of niches. As a result there is competition between the taxa for the niches available which result in each being filled with a different taxon and most of those present have relatively small populations. One reason the number of habitats should be similar is because variations of similar magnitude exist for the same important environmental factors in any given area. That the number of taxa available for occupying the habitats suitable for the group is greater than those occurring is indicated by the rapid change in kinds of taxa present when the environment is slightly different although the numbers of taxa remain similar. This is best illustrated by the change in taxa occurring in the same area when collected at the same season in two different years. Data not yet published show for diatom populations similar variability in the same area from month to month. The collecting methods were designed to collect all taxa which were living and collectable in a given area, and a great deal of time was spent collecting relatively small areas. The systematic studies have also been very thorough so that all entities have been defined if not identified. The main problem is probably the collectability of the species. Many taxa exist during periods which are not optimum for their development in very small populations. Other taxa due to their life cycle exist in such minute forms at certain times of the year that they are uncollectable. Due to variation in the environmental factors, the ecological conditions of a river may be very different on the same day of the same season in two different years and hence the collectable taxa may vary greatly. Likewise the collectable populations may vary from month to month. In organisms with short life cycles even a few days can cause a considerable change in the relative population sizes of the taxa. (Auth.)

5755. Ruttner, Franz. 1962. PRINCIPLES OF LIMNOLOGY. (HYDROBIOLOGY OF FRESH

WATER). (GRUNDRISS DER LIMNOLOGIE. (HYDROBIOLOGIE DES SUSSWASSERS).) 3rd ed. 332 pp. Illus. Walter De Gruyter and Co.: Berlin; Biological Abstracts, Vol. 41, No. 4, Abst. No. 13098. 1963.

This volume brings up to date the advances in limnology and correlates research in this science during the last 10 years. The table of contents include: "Introduction"; "Water as Living Space"; "Physical Environmental Conditions"; "Specific Gravity, Toughness, Interfacial Tension"; "Behavior of Water Towards the Rays of the Sun"; "Movements of Waves"; "Dissolved Material and its Transformation"; "The Circulation of Carbonic Acid"; "Oxygen Content"; "Elementary Nitrogen and Methane"; "Iron and Manganese"; "Nitrogen and Phosphorus"; "Other Minerals"; "Organic matter"; "The Law of Minimums"; "Biological Communities"; "Plankton"; "Suspensions in the Water"; "Composition of Plankton"; "Spatial Division"; "Division by Time"; "The Bacteria of Plankton"; "The Production Problem"; "Review of Other Biological Communities of the Lake"; "Formations and Organization in the Deeper Regions of the Lake"; "Shore Vegetation"; "Biological Communities in Swamps"; "Biological Communities in Flowing Water". The book is well-illustrated and documented and contains a glossary of technical expressions and an author and subject index. (J. G. S.)

5756. Balon, Eugeniusz K. (Czechoslovak Acad. Agric. Sci., Bratislava). 1962. AGE AND GROWTH OF THE SPAWNING STOCK OF THYMALLUS THYMALLUS (LINNAEUS, 1758) FROM A RESERVOIR, LAKE ON HNILEC RIVER. (VEK A RAST NERESOVÉHO STÁDA LIPŇA (THYMALLUS THYMALLUS (LINNAEUS, 1758)) Z ÚDOLNEJ NÁDRŽE NA RIEKE HNILEC.) Zool. Listy 11(25): 145-154; Biological Abstracts, Vol. 41, No. 4, Abst. No. 13108. 1963.

Growth of the fish of economic importance in a typical salmonid riverine lake on Hnilec River, Slovakia, was studied. A total of 62 graylings were evaluated, belonging to a spawning shoal and captured during spawning migration from the riverine lake to spawn in the river. On their scales, juvenile marks, normal and spawning annuli were determined. Body length in the earlier years of life were back-calculated from their scales by using a logarithmic method. Up to now the grayling has been believed to be a typical rheophilic fish. However, it is seen, from the example of the Hnilec Basin, that even the grayling is capable of adaptation to changed environmental conditions and of producing, within a short period of time, a limnophilic form migrating to rivers only for spawning. Its confinement to a reservoir also induces a change in body dimensions and robustness. (Auth.)

5757. Beaulieu, G. (Dept. Pêcheries, Quebec, Canada). 1962. RESULTS OF TAGGING STRIPED BASS IN THE SAINT LAURENCE RIVER DURING THE PERIOD 1945 TO 1960. (RESULTATS

D'ETIQUETAGE DU BAR D'AMERIQUE, DANS LE FLEUVE SAINT LAURENT DE 1945 A 1960.) Nat. Canadien 89(8/9): 217-236; Biological Abstracts, Vol. 41, No. 4, Abst. No. 13111. 1963.

Of 2921 tagged striped bass, Roccus saxatilis (Walbaum), 290 were recaptured. Two-thirds of the fish were mature when tagged. The adults and larger immature fish migrated in spring and summer towards the Ile d'Orleans region. In the fall the young fish move eastward as far as Riviere-Quelle. The data also indicate a rapid rate of growth in this species. (G. R. B.)

5758. Fortunatova, K. R., and N. I. Chugunova. 1960. THE RELATION OF RETENTION OF TAGS TO THE BEHAVIOR AND ENVIRONMENTAL CONDITIONS OF FISHES. (ZAVISIMOST' SOKHRANOSTI METOK OT POVEDENIYA I USLOVYI OBITANIYA RYB.) Voprosy Ikhtiol. 15. 91-105; Referat. Zhur., Biol., 1961, No. 15D470; Biological Abstracts, Vol. 41, No. 4, Abst. No. 13131. 1963.

Observations were conducted under experimental conditions approximating the natural on the crucian carp (Carassius carassius) and carp (Cyprinus carpio). These observations allowed determination of the causes and methods of loss of tags and established connections between these losses and the behavior and biology of the fish. Carassius carassius were tagged in 1944 and 1945 in the flooded valley of the Klyaz'ma River, Cyprinus carpio in 1956 and 1957 in the Volga delta. Two types of identifying tags were employed, staples and disks. It was shown that more tags of the staple variety were retained, and that disks are unsuitable for tagging deep fresh-water fish over an extended period of time. Loss of tags took place as a consequence of the rupture of tissue in the region of attachment and the instability of the material with which they were attached. The percentage loss depends upon the season in which tagging took place. The rapidity of loss is connected with the behavior of the fish. Therefore, it is necessary to consider the ecology of fish before tagging.

5759. Ioganzen, B. G., B. K. Moskalenko, and A. N. Gundrizer. 1959. POSSIBLE EFFECTS OF THE PROJECTED LOWER OB HYDROELECTRIC STATION ON FISH IN THE OB RIVER BASIN. (VOZMOZHNOE VLIYANIE PROEKTIRUEMOI NIZHNEOBSKOI GES NA RYB BASSEINA REKI OBI.) Tomskii Inst.: Tomsk 185-190; Referat. Zhur., Biol., 1961, No. 1D499; Biological Abstracts, Vol. 41, No. 4, Abst. No. 13153. 1963.

A radical change in the migration of migratory fish will take place when the dam is built across the lower Ob. The hydroelectric station will affect most strongly the population of the Ob-Irtysh. Proposals are given for piscicultural measures to safeguard the normal propagation of commercially valuable fish, and the controlled development of the fish-fauna of the reservoir.

5760. Pankratova, V. Y. 1959. THE BOTTOM FAUNA OF EZERGALYU POND. (DONNAYA

FAUNA PRUDA EZERGALYU.) Trudy Inst. Biol. Akad. Nauk Latvinskoi SSR 8. 3. 345-358; Referat. Zhur., Biol., 1961, No. 6D523; Biological Abstracts, Vol. 41, No. 4, Abst. No. 13186. 1963.

Ezergalyu Pond is stocked with fish in the spring and drained in the fall. Various combinations of mineral and organic fertilizers were introduced systematically into the reservoir from 1954 on. This process was particularly intensive during 1956, when the benthonic fauna was investigated. A detailed analysis is given of the structure, distribution and seasonal dynamics of benthonic organisms. The fertilization proved beneficial to the development of benthic fauna, in which organisms includable in the diet of the fish (primarily larvae of Tenedipodidae) predominated. The quality of benthonic animals comprised on the average 2400 individuals/m², while the biomass was 8.1 g/m². Development of the benthic fauna showed an irregular pattern in time for different sections of the reservoir, which was beneficial in insuring a continuous supply of food for fish over the entire period. An increase in fish productivity from 288 kg/ha in 1955 to 635 in 1956 is ascribable to fertilization of the reservoir.

5761. Ulomskii, S. N. 1959. DEVELOPMENT AND UTILIZATION OF PLANKTON IN URAL LAKES WITH A DENSE FISH POPULATION, THOSE WITH A SPARSE FISH POPULATION, AND THOSE LACKING A FISH POPULATION. (RAZVITIE I ISPOL'ZOVANIE PLANKTONA V RYBNIKH, MALORYBNIKH I BEZRYBNIKH OZERAKH URALA.) Tomskii Inst.: Tomsk 257-262; Referat. Zhur., Biol., 1961, No. 1D501; Biological Abstracts, Vol. 41, No. 4, Abst. No. 13225. 1963.

Results are given of a study of several shallow lakes in the southern Ural. The lakes are characterized by a variable water regime, periodic shoaling, and as a result, mortality during periods of drought.

5762. Zemskaya, K. A. 1961. THE GROWTH OF FISHES IN POPULATIONS WITH NEGLIGIBLE FLUCTUATIONS IN NUMBERS. (ROST RYB V POPULYATSII S NEZNACHITEL'NOI AMPLITUDOI KOLEBANII CHISLENNOSTI.) Voprosy Ikhtiol. 1 (4): 690-694; Referat. Zhur., Biol., 1962, No. 9I50; Biological Abstracts, Vol. 41, No. 4, Abst. No. 13234. 1963.

A study was made of the growth of the flounder, Pleuronectes flesus trachurus Duncker, in the Baltic Sea as it is influenced by density of stock and environmental conditions determining food consumption. The age and growth rate of 3000 individuals was determined by back calculation from otoliths for the period 1957-1959. The growth rates for 6-year-olds of two different year-classes showed that the greatest growth in length took place in the second year, after which growth gradually slowed. In the 5th year an increase in growth was observed which was distinctive for this species; its cause was probably the changeover of the fish to feeding on large mollusks. No linear relation between the individual growth of fish and their food

supply was observed, probably because of the relatively small thinned stock, which is always supplied with food. The growth of P. f. trachurus in different years showed that the age groups of different year-classes demonstrated good increments in length only in 1954 and 1957; this was caused fundamentally by thermal conditions which regulate the metabolic rate of fishes and extend or contract the period of intensive feeding; the average monthly temperature from May to July of these years was 1.5° C higher than the long-term average for these months. The author comments on the variability in size of these fish in different areas of the sea.

5763. Balakhnin, I. A. 1962. A METHOD OF DETERMINING INTRA-SPECIES DIFFERENCES IN TROUT BLOOD. Doklady Akad. Nauk SSSR 141(1/6): 1063-1064; Biological Abstracts, Vol. 41, No. 4, Abst. No. 16836. 1963.

The method entails a test of the agglutinating properties of a pig serum previously exhausted of its agglutinins with respect to the erythrocytes of one individual fish. A small number of washed erythrocytes from the fish under test are introduced into 2 drops of such serum and the degree of clotting estimated by the naked eye or by use of a hand lens.

5764. Midttun, L., and I. Hoff (Fiskeridirekt., Bergen, Norway). 1962. MEASUREMENTS OF THE REFLECTION OF SOUND BY FISH. Fiskeridirekt. Skrifter Ser. Havundersokelser 13(3): 1-18; Biological Abstracts, Vol. 41, No. 4, Abst. No. 16840. 1963.

In cod (Gadus morrhua) and hake (Pollachius virens), the air bladder accounts for the major part of sound reflection. For this reason, the angle of inclination of the fish and the shape and size of its air bladder affect the sound reflectivity. (R. P. E.)

5765. De Smet, W. (Inst. Zool., Louvain Univ., Louvain, Belgium). 1962. CONSIDERATIONS ON THE STANNIUS CORPUSCLES AND THE INTERRENAL TISSUES OF BONY FISHES, ESPECIALLY BASED ON RESEARCHES INTO AMIA. Acta Zool. 42(2/3): 201-219; Biological Abstracts, Vol. 41, No. 5, Abst. No. 19070. 1963.

In the actual zoological literature widespread confusion still exists as to the homologues in bony fishes of the mammalian adrenal cortex. Investigations, particularly those of Giacomini, have clearly shown that in teleosts the true homologue is the so-called interrenal tissue, situated in the pronephric zone. Entirely different organs are the Stannius corpuscles, situated in the posterior kidney zone and originating as outgrowths of the pronephric duct. Such outgrowths have also been found in great numbers in Lepisosteus and in Amia. In the latter they even originate as outgrowths of the distal part of the nephron tubule; this, firstly stated by Garrett in the embryo, has been found as being a normal process in any nephron tubule in

Amia. In other primitive fishes as in Acipenser and in Polypterus such glands are lacking. Actual physiological data can give no answer to the problem of their function. In more advanced forms they may be osmoregulatory. In any case they are not homologous with the Mulerian duct. (Auth.)

5766. Bilyi, M. D. 1961. THE ROLE OF THE COLOR OF THE BOTTOM AND THE NESTING MATERIAL IN THE SELECTION OF SITES SUITABLE FOR SPAWNING BY REPRODUCTIVE FISH. (ROL' KOL'ORU DNA I SUBSTRATU PRY ROZSHUKUVANNI PLIDNYKAMY RYB MISTS', PRYDAT-NYKH DLYA NERESTU.) Dopovidi Akad. Nauk Ukrain. R.S.R. 10. 1389-1392; Referat. Zhur., Biol., 1962, No. 10135; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17191. 1963.

Artificial nests were constructed on backgrounds of various colors. Judging from the appearance of eggs in the nests, bream, sander and sea-roach will spawn on material of various colors. When artificial nests of caprone which had been dyed various colors (red, black, green, azure, brown, blue, yellow, white and grey) were placed in the spawning grounds along with nests of plant roots, the fish still showed no preference for a particular color. The author concludes that the color of the nesting material plays no significant role in the selection by fish of sites suitable for spawning.

5767. Erman, L. A. 1962. THE UTILIZATION OF THE TROPHIC RESOURCES OF WATER BODIES BY PLANKTON ROTIFERS. (OB ISPOL'ZOVANII TROFICHESKIKH RESURSOV VODOEMOV PLANKTONNYMI KOLOVRATKAMI.) Byull. Moskov. Obschestva Ispytatelei Prirody. Otdel Biol. 67(4): 32-47; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17261. 1963.

The intestine content of plankton rotifers in 52 reservoirs of various types was studied. Simultaneously the zoo- and phytoplankton composition was estimated quantitatively, test sampling was carried out in specimen taken from residues and net catchings. Keratella cochlearis, Brachionus angularis and Filinia longiseta prove to be the predominant consumers of detritus among the total mass of rotifera species. Synchaeta pectinata, Epiphanes senta and Polyarthra species show preference for relatively large and mobile criptomonadina, chrysomonadina and Volvocales species. Brachionus calyciflorus and Keratella quadrata consume mainly the nanotype phytoplankton. The latter may consume detritus. The rotifers related to the Asplanchna genera actively select their animal food (other rotifera). A. priodonta is more adopted to emergency feeding with algae than A. brightwelli. Owing to the extremely wide-range variety of the feeding stuff material and to the high rate of trophic plasticity, the rotifers are able to exist on selective feeding and to take to narrow specialization in choosing food for living. The peridinean, large blue-green and the large-sized diatom algae which may be viewed as a trophic deadlock in the fresh-water plankton reservoirs are hardly consumed by

the plankton rotifers. Making use of several basic forms of primary productivity of the fresh-water reservoirs (protococcales, chrysomonadina and cryptomonadina algae) the rotifera ought to play a significant role in their trophodynamics. (Auth.)

5768. Bogdanova, E. A. 1962. MALACHITE GREEN AND FORMALIN -- EFFECTIVE AGENTS FOR THE CONTROL OF TRICHODINIASIS. (MAL-AKHITOVAYA ZELEN' I FORMALIN -- EFFEKTIV-NYE SREDSTVA BOR'BY S TRIKHODINIAZISOM.) Rybnoe Khoz. 38(8): 30-31; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17281. 1963.

The chief disease of young salmon in Far Eastern waters is trichodiniasis, caused by Trichodina trutta Mueller. These infusorians are described. The author describes a method by which large numbers of fish are treated with a bath of formalin (1:4000 dilution) or malachite green (1:700,000 or 1:100,000 dilutions) for 10-15 min. Trichodina are killed and washed off the fish with a stream of water. These agents can also be used for prevention of trichodiniasis in ponds where fish are being raised, and saprolegniasis in salmon eggs during incubation. (M. D.)

5769. Holden, A. V. (Freshwater Fish. Lab., Pitlochry, Perthshire, Scotland). 1962. A STUDY OF THE ABSORPTION OF ¹⁴C-LABELLED DDT FROM WATER BY FISH. Ann. Appl. Biol. 50(3): 467-477; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17306. 1963.

¹⁴C-DDT absorbed by Salmo trutta from 0.5 and 0.1 ppm aqueous suspensions was found in all 14 organs and tissues examined, using a direct mount method on lipid extracts. The concentration in the gills was proportional to the aqueous concentration at death, but about 280 times greater. DDT in the gills, heart and liver was wholly or largely present in the blood in these organs. Storage occurred mainly in the stomach, pyloric caeca, intestine, spleen, muscle and skin, and possibly in the kidneys. Concentrations per unit weight of lipid showed more uniformity than per unit weight of tissue. Concentration in the lipids may determine toxicity to fish, explaining the greater susceptibility to DDT of fish in poor condition or of low fat content. Absorption from the water was very rapid, indicating that static water testing of insecticide toxicity to fish is unreliable. (Auth.)

5770. Holt, S. J. (Fish. Div., F.A.O., Rome, Italy). 1962. THE APPLICATION OF COMPARATIVE POPULATION STUDIES TO FISHERIES BIOLOGY. AN EXPLORATION. Brit. Ecol. Soc. Symposium 2: 51-71; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17308. 1963.

The annual catch of fish from a stock is given by the integral, over the fishable life-span, of the product of an instantaneous fishing mortality coefficient, a function giving the number of fish remaining at a certain time from an initial number of recruits in terms of coefficients of mortality, and a function defining the body weight of fish at each

age. If the ages of fish in a sample can be determined, then the coefficients of mortality may be estimated from the age compositions of catches, and the growth parameters from the curve of fish size at age. The growth parameters can also be estimated from, for example, data of marking experiments, without knowledge of absolute age. The process of marking affects, however, the growth rate of fish, but it seems to affect L_{∞} rather than K . This would be expected if marking primarily interfered with the feeding of the fish. The simple equation for yield can be put in a form in which the mortality coefficients appear only as numerators of fractions in which the denominator is a growth parameter. Tables of the incomplete Beta-function can be used to evaluate yield. The equation can be expressed to give yield in terms of the growth parameter and of the relative lengths of fish at first liability to capture and at the end of the fished life-span. Comparative studies indicate that the growth parameter K increases with increase in water temperature, but that the natural mortality may vary in the same direction. Intraspecific (sexual) and interspecific relations between these parameters seem generally to be of a similar kind. Not only is their ratio relatively invariable, but it may have a characteristic limited range of values for groups of fishes up to the Order level. The ratio may be estimated from size compositions of catches if the asymptotic length can be determined. Statements in literature to the effect that sexual maturity occurs at a size about two-thirds of the final length (= one-third of asymptotic weight) suggested comparative study of the relations between maturity size and age and growth rate, because determination of the mean or median size of maturity does not require age-determination. This study revealed that the ratio of size at maturity to asymptotic size does indeed vary over a restricted range, but it is correlated with K . The implications of this relation are considered with regard to the use of maturity studies in stock assessment. (Auth.)

5771. Karzinkin, G. 1962. RADIOACTIVE ISOTOPES IN PISCICULTURE. (RADIOAKTIVNYE IZOTOPY V RYBOVODSTVE.) Rybovodstvo i Rybolovstvo 1. 8-9; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17315. 1963.

Radioactive isotopes can be used in studying the regular features of and the processes taking place in water bodies. C^{14} is used at present to determine the extent of the synthesis of organic matter by phytoplankton. P^{32} can be used to track fertilizer from algae to fish. Experiments with calcium chloride (with Ca^{45}) demonstrated that fish kept on a calcium-free diet are able to obtain 95-97% of their calcium requirement from calcium salts dissolved in the water; this was done primarily through the gills and, to a lesser extent, through the skin. Further experiments revealed that a low ratio of Mg to Ca was significant in the growth of fish. It was found that in carp, carbon participates in the synthesis of glycogen, fats and

proteins. Sulfur was found to be important in the synthesis of proteins. Radioactive isotopes were also used in studying the role of trace elements in the bodies of fish. (N. F.)

5772. Kislyakov, A. G. 1961. RELATIONSHIP BETWEEN HYDROLOGICAL CONDITIONS AND FLUCTUATIONS IN THE NUMBERS OF SUCCESSIVE YEAR-CLASSES OF COD. (SVYAZ' GIDROLOGICHESKIKH USLOVII S KOLEBANIYAMI CHISLENNOSTI POKOLENII TRESKI.) Trudy Soveshchaniy Ikhtiolog. Komissiya Akad. Nauk SSSR 13. 260-264; Referat. Zhur., Biol., 1962, No. 12143; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17316. 1963.

A relationship was established between the water temperature at the cod spawning grounds and the size of the next generation ($r = 0.91 \pm 0.04$), expressed by the equation: $x = 1.24y - 5.0$ where x is the size of the year-class on an arbitrary scale and y is the average temperature of the 0-200 m layer in the middle of April. Thus reproduction is more successful in warm years. This may be explained by the early onset of biological spring, as well as by the freshening of the surface strata, as a result of which the fish larvae descend to deeper strata and are not injured by wave action, therefore developing and going over to active feeding more rapidly due to the early development of the plankton.

5773. Konstantinov, K. G. 1962. LOCAL SCHOOLS OF SEA PERCH IN THE NORTH ATLANTIC. (O MESTNYKH STADAKH OKUNYA-KLYUVACHA SEVERNOI ATLANTIKI.) Rybnoe Khoz. 38(2): 12-15; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17318. 1963.

Work on local populations of the redfish *Sebastes mentella* has been in progress since 1952. Commercial fish in the Barents Sea south of Bear Island average 35 to 45 cm in length and are 14 to 18 years old. On the Rosengarten Banks between Iceland and the Faeroe Islands the fish are 18 to 24 years old and 42 to 50 cm long. The conclusion was drawn that as the fish mature they migrate from the Barents Sea to the Rosengarten Banks; thus the size of the population at the Banks is governed by the size of the population in the Barents Sea. Murmansk trawlers work successfully at Bear Island from July to September. Morphometric analysis of 5 characteristics was made. Tables are given comparing measurements of fish in different locations. The results confirm migration patterns worked out by PINRO. Populations in the North Atlantic represent a number of practically isolated local groups. (M. J. H.)

5774. Lapin, Yu. E. 1961. TYPES OF SPAWNING POPULATIONS AND SOME QUESTIONS CONCERNING THE TECHNIQUES OF STUDYING THE POPULATION DYNAMICS OF COMMERCIAL FISH. (TIPY NERESTOVYKH POPULYATSII I NEKOTORYE VOPROSY METODIKI ISSLEDOVANIYA DINAMIKI CHISLENNOSTI PROMYSLOVYKH

RYB.) Voprosy Ikhtiol. 1(4): 666-680; Referat. Zhur., Biol., 1962, No. 12142; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17326. 1963.

By the use of simple mathematical models (numerical tables), it is possible to change the values for recruitment, loss, rate of maturation and individual life span at will and then derive the changes in the structure of the population. The author has studied the dynamics of populations with various individual life spans, both when not subjected to fishing and when fished at various rates.

5775. Le Cren, E. D. (Freshwater Biol. Assoc., Ambleside, Westmorland, England). 1962. THE EFFICIENCY OF REPRODUCTION AND RECRUITMENT IN FRESHWATER FISH. Brit. Ecol. Soc. Symposium 2: 283-296; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17331. 1963.

A consideration of some estimates of production from a few species of freshwater fish shows that the production of gonad products can be as large as the growth production of new flesh, and is probably usually a significant proportion of the total production. Little of the production of juvenile fish survives to recruitment and so the overall reproductive and recruitment process is inefficient. However, this efficiency is inversely related to population density and so is a precaution against the occasional catastrophic density-independent mortality. Fishery management should aim to understand these processes better so that management practices can be designed to reduce unnecessary natural propagation and juvenile mortality. (Auth.)

5776. Lockie, J. D. (Nat. Conserv., Edinburgh, Scotland). 1962. GREY SEALS AS COMPETITORS WITH MAN FOR SALMON. Brit. Ecol. Soc. Symposium 2: 316-322; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17334. 1963.

During the 1957 salmon fishing season, man removed 731,000 lb of salmon and seatrout. A very imprecise calculation suggests that immature grey seals and young bulls removed 23,000 lb of salmon and seatrout from the same area, or about 2 percent of the total catch (range, 0.3 to 30%). In addition, there is an unknown amount eaten by an unknown number of mature seals. Clearly we do not yet know enough to draw conclusions about grey seals as competitors with man for free-living salmon even on this rather well-documented section of the British coast. The more serious gaps in our knowledge which are necessary for this kind of study can be listed as follows: The annual mortality of the various age-groups. The exact age at which breeding commences in each sex. The distribution of immature animals. The age-groups frequenting the salmon nets. A food study that takes into account the limitations of stomach analysis and the difficulties of sampling in the field. Some of these are already under investigation. (Auth.)

5777. Mamontova, L. I. 1961. INCREASING THE FISH PRODUCTIVITY OF REARING PONDS BY

THE USE OF FERTILIZERS. (POVYSHENIE RYBO-PRODUKTIIVNOSTI VYROSTNYKH PRUDOV PUTEM PRIMENENIYA UDOBRENIY.) Doklady Moskov. Sel'skokhoz. Akad. Im. K. A. Timiryazeva 69. 171-174; Referat. Zhur., Biol., 1962, No. 10163; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17337. 1963.

Addition of ammonium nitrate and superphosphate to ponds increased the natural food supply and thus decreased the expenditure of artificial food by 30-50%. The density with which the ponds were stocked was increased to 80-120 thousand fry and 5 g N and 0.2 g P were added to each cubic meter of water. The breeding ponds were fertilized 10 days before stocking by adding a single dose for 5 days. Tripling the stocking density and adding ammonium nitrate and superphosphate to the pond water increased the fish productivity from 2 to 7-8 metric centners/ha and to 10.7 centners/ha after a 5-fold increase in stocking density. The consumption of fertilizer per season and per hectare was 15-20 metric centners of ammonium nitrate and 3 centners of superphosphate. It is recommended that rearing ponds be fertilized with ammonium nitrate and superphosphate simultaneously at doses of 1 g N and 0.05 g P/m² of water. The consumption of fertilizer/ha is 5-6 centners of ammonium nitrate and 1-2 centners of superphosphate.

5778. Popov, A. V., and A. I. Zotin. 1961. THE RELATIONSHIP BETWEEN THE TIME OF HATCHING OF SALMON AND WHITEFISH EMBRYOS AND CERTAIN ENVIRONMENTAL FACTORS. (ZAVISIMOST' VYLUPLIENIYA ZARODYSHEI LOSOSEVYKH I SIGOVYKH OT NEKOTORYKH FAKTOROV SREDY.) Rybnoe Khoz. 11. 22-28; Referat. Zhur., Biol., 1962, No. 13162; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17364. 1963.

The time at which salmon and whitefish embryos hatch depends upon the oxygen conditions, the velocity of water flow in the apparatus, and the illumination. Of these factors, only the last two may be utilized to regulate the hatching process under commercial conditions, since altering the oxygen content may lead to the death of the embryos. The hatching of whitefish embryos is accelerated when the water flow is stepped up and when the eggs develop in the dark, while the hatching of salmon and trout embryos proceeds more rapidly in the light and at a slow water flow.

5779. Smetanich, V. S. 1961. AN INTERESTING EXPERIMENT IN IMPROVING THE UTILIZATION OF THE FISH STOCKS IN RESERVOIRS. (INTERESNYI OPYT PO ULUCHSHENIYU ISPOL'ZOVANIYA RYBNYKH RESURSOV VODOKHRANILISHCH.) Geografiya i Khozyaistvo 10. 71; Referat. Zhur., Biol., 1962, No. 12190; Biological Abstracts, Vol. 41, No. 5, Abst. No. 17376. 1963.

In order to improve the utilization of reservoirs as a source of fish, it is recommended that shallow bays be separated from the main area of the reservoir and transformed into fattening and rearing sectors.

5780. Kazarnovskii, M. Ya. 1962. FOOD OF MIGRATING FRY OF ONCORHYNCHUS GORBUSCHA AND SALVELINUS MALMA IN THE RIVERS OF SAKHALIN. (PITANIE POKATNOI MOLODI GORBUSHI I MAL'MY V REKAKH SAKHALINA.) Rybnoe Khoz. 38(6): 24-25; Biological Abstracts, Vol. 41, No. 5, Abst. No. 20992. 1963.

Studies made in 1960 showed that fry of Oncorhynchus gorbuscha hardly ate at all in the rivers. Empty stomachs were found in 96.8% of all the specimens examined. The percentage with food in their stomachs was somewhat higher among those migrating into the sea at the end of June to the beginning of July. Larvae of Chironomidae were the chief source of food. Mayfly and caddis fly larvae, water mites, and winged insects were also found. Salvelinus malma fry began to feed actively as soon as they emerged from their redds. Empty stomachs were found in only 25.9% of the specimens examined. S. malma lived close to the banks and in stagnant parts of the rivers. The chief sources of food (by weight) for this sp. were winged insects and mayfly and midge larvae. Midge pupae, stone fly larvae, Amphipoda, Crustaceae, and water mites were also found. The average weight of S. malma (232 mg) was appreciably higher than that of O. gorbuscha (199.4 mg), while their lengths were 30.6 mm and 32 mm, respectively. On the basis of these data, the author concludes that S. malma and O. gorbuscha do not compete with one another for food in the rivers of Sakhalin. (M. D.)

5781. Shentyakova, L. F. 1961. THE USE OF CHEBYSHEV'S METHOD FOR CALCULATING THE GROWTH OF FISH FROM THE SCALES. (PRIMENENIE SPOSOBA CHEBYSHEVA K METODIKE REKONSTRUKTSII ROSTA RYB PO CHESHUE.) Trudy Inst. Biol. Vodokhranilishch Akad. Nauk SSSR 4(7): 281-293; Referat. Zhur., Biol., 1962, No. 10116; Biological Abstracts, Vol. 41, No. 5, Abst. No. 20999. 1963.

An analysis of existing methods for calculating the growth of fish from scale measurements showed that the principal deficiencies of these methods lay in the inadequate techniques for mathematical treatment of the results of the observations, and in the lack of study of the intraspecific characteristics of the relationship between the growth of the body and the scales in fish. A way is suggested for perfecting the techniques of interpolation in the treatment of the experimentally observed data. The question of the intraspecific specificity of the line of regression based on visible characteristics remains open. Chebyshev's method is used to construct a line of regression, and this is then plotted graphically on a logarithmic scale. Diagrams are shown for the bream from various reservoirs. A comparison of the distribution diagram for bream from the Rybinsk, Gor'ki and Kama Reservoirs with that for pike perch and roach from the Rybinsk Reservoir showed that in all cases on a logarithmic scale the degree of scatter of the points was insignificant and the principal axis of the distribution diagram had a curved shape. The advantage of Chebyshev's

method is that it makes possible a gradual increase in the order of the curves, and that the calculations for the previous degrees are completely utilized in the subsequent computations. Besides, for each curve of any particular order, the principal error is immediately calculated, on the basis of which one can determine the degree to which the calculated curve approximates the observed data. All the computations are facilitated by the existence of convenient auxiliary calculating tables. An example is given of the derivation of a formula for the logarithmic anamorphosis of the regression line for bream from the Rybinsk Reservoir by Chebyshev's method, which shows that a formula calculated in this way most accurately reflects the relationship between the growth in radius of the scales and the length of the fish, yielding the smallest sum of the squares of the deviations of all points on the distribution diagram from the constructed regression line.

5782. Kudryns'ka, O. I. 1962. CANNIBALISM AMONG THE LARVAE AND FRY OF THE CARP. (KANIBALIZM U LYCHYNOK I MAL'KIV SAZANA.) Dopovidi Akad. Nauk Ukrain. R.S.R. 1. 111-113; Referat. Zhur., Biol., 1962, No. 12162; Biological Abstracts, Vol. 41, No. 6, Abst. No. 21356. 1963.

Among the roe from a single pair of progenitors under identical conditions there is always a certain percentage of larvae which develop more rapidly. In stage D, the difference in size among carp larvae reaches significant proportions. In this stage the large larvae prey on the smaller ones, even in the presence of abundant plankton.

5783. Zusser, S. G., and R. M. Etingen. 1961. EFFECT OF THE PHYSIOLOGICAL CONDITION OF FISH (LEUCOSPIUS DELINEATUS) ON THEIR RESPONSE TO LIGHT. (VLIYANIE FIZIOLOGICHESKOGO SOSTOYANIYA RYB NA IKH REAKTSIYU NA SVET.) Rybnoe Khoz. 11. 19-21; Referat. Zhur., Biol., 1962, No. 12177; Biological Abstracts, Vol. 41, No. 6, Abst. No. 21360. 1963.

The experiments were carried out in an aquarium, half of which was darkened while the other half was illuminated; an opening was made in the partition to permit free movement of the fish. Hungry specimens of L. delineatus were more active in swimming into the lighted half than satiated individuals (from January to August). During the pre-spawning period, the response to light was depressed in both hungry and satiated specimens, becoming activated again at the end of spawning.

5784. Breslau, Lloyd R., John M. Zeigler, and David M. Owen. 1962. A SELF-CONTAINED PORTABLE TAPE RECORDING SYSTEM FOR USE BY SCUBA DIVERS. Bull. Inst. Oceanogr. Monaco 1235. 1-4; Biological Abstracts, Vol. 41, No. 6, Abst. No. 21420. 1963.

A self-contained system, involving a small portable tape recorder, hydrophone, and full-faced breathing mask, has been devised to enable a SCUBA diver to effortlessly make a continuous vocal

record of his observations during a dive. (Authors)

5785. Elgmork, K. (Limnol. Dept., Univ. Oslo, Blindern, Norway). 1962. A BOTTOM SAMPLER FOR SOFT MUD. *Hydrobiologia* 20(2): 167-172; Biological Abstracts, Vol. 41, No. 6, Abst. No. 21422. 1963.

The apparatus described consists of a perspex tube, 7 cm diameter, which is lowered into the mud at the bottom of a lake. The tube is fitted with lids which are closed by a mechanism similar to that used on a Friedinger water sampler. A piston to facilitate the removal of the core is incorporated in the lower lid. Detailed drawings and photographs of the sampler are given. As an example of the use of the sampler, data are given of the vertical distribution of *Chaoborus* in the profundal mud of Linsley Pond, Connecticut, in April 1960. (K. E. M.)

5786. Ayers, John C. (Inst. Sci. and Technol., Univ. Ann Arbor, Michigan). 1962. GREAT LAKES WATERS, THEIR CIRCULATION AND PHYSICAL AND CHEMICAL CHARACTERISTICS. *Publ. Amer. Assoc. Advance. Sci.* 71. 71-89; Biological Abstracts, Vol. 41, No. 6, Abst. No. 21491. 1963.

The circulation of water in the Great Lakes involves surface and subsurface currents, with a seasonal cycle of vertical circulation superimposed. Current patterns are determined by wind, flow-through of drainage water, rotation of the earth, and local influences. Surface currents may have a primary geostrophic relationship to the density field or a secondary relationship in which boundaries or wind setup play a part. Surface currents lag behind the causative wind by periods ranging from two hours in shallow water to a day in deep basins. Current patterns in deep basins apparently involve energy increments from winds of the preceding 10 to 12 days, with the increments decreasing exponentially in effectiveness with increasing time prior to the observation day. Primary physical characteristics of the lake waters are their "soft-water" nature; their seasonal cycles of turnover, lake levels, and precipitation; and their short-period seiches. The lakes exhibit a modified seasonal turnover cycle; wind mixing establishes turnover at the end of the fall cooling period and maintains it throughout the winter until the spring warming period is established. Cycles of lake level occur annually; the levels are low in midwinter and high in midsummer. Superimposed upon the annual cycles are multiyear cycles of level. In chemical characteristics Great Lakes waters show relationship to their geological ages, their drainage area rocks, and to their peripheral human population densities. Only Lake Superior has shown no change in chemical characteristics in the past 50 to 75 years. Lake Erie, oldest and most heavily populated, has deteriorated in chemical quality during the past hundred years, with increasingly rapid deterioration in the last fifty years. (Auth.)

5787. Baranov, I. V. 1961. THERMIC AND

HYDROCHEMICAL CONDITIONS IN THE GOR'KOV-SKII RESERVOIR. (TERMICHESKII I GIDROKHIMICHESKII REZHIEM GOR'KOVSKOGO VODOKHRANILISHCHA.) *Trudy Inst. Biol. Vodokhranilishch Akad. Nauk SSSR* 4(7): 294-320; Referat. Zhur., Biol., 1962, No. 11Zh332; Biological Abstracts, Vol. 41, No. 6, Abst. No. 21492. 1963.

The affluent of the Gor'kovskii Reservoir extends for 434 km to the Rybinsk Dam. Its surface area is 1611 km², its average depth 6.4 m, and its greatest depth 23 m. Except for the Volga channel section, the Gor'kovskii Reservoir is a shallow-water body: 57-77% of the bottom area is from 1 to 10 m deep, and 20-22% of the bottom area is from 10-23 m deep. On the basis of morphometric, hydrologic, and hydrochemical indices, the reservoir is subdivided into 3 sections or reaches: the upper river reach from Rybinsk to the mouth of the Elnata River, the Kostroma overflow, and the lower-extending reach from the mouth of the Elnata River to the dam of the Gor'kovskii electrical station. In the upper reach, after creation of the hydroelectric station, the water was almost everywhere stopped at the old shores of the Volga, and all year round there is a flow of river water here. In the lower reach, the flooded bottom-land extends in places for 12-14 km; in the summer, the current is weak. The thermic conditions of the Volga in the summer period determine the temperature of the air. The greatest warming up of the water mass in June-July amounted to 28-29° C. In the winter, the water temperature decreased to 0.0-0.1°. The transparency of the water in the reservoir in the summer period was 120-200 cm by the white disk method. It was lowest in spring and autumn. After the river was controlled, the transparency of the water increased two- to three-fold, and the mineral content of the water fell sharply. Except in the shallows, the oxygen conditions in the reservoir are normal in most of its area. For the maintenance of favorable conditions of existence for fish, the water level in the reservoir must not fall more than 2 m below the normal supported horizon.

5788. Joseph, John M., Sally A. T. Clapp, and W. Gary Leathers (Dept. Biol., Findlay Coll., Findlay, Ohio). 1962. METHOD FOR REARING MIXED CULTURES OF FRESHWATER MICROORGANISMS. *Turtox News* 40(10): 254-255; Biological Abstracts, Vol. 41, No. 6, Abst. No. 21510. 1963.

Hemp seeds cut transversely and placed in pond water will cultivate many organisms. Succession, food habits, and food webs as well as life cycles may be observed. (R. W. D.)

5789. Kabanov, N. M. 1961. MACROPHYTES AND PLANKTON OF CONTROLLED WATER BODIES. (MAKROFITY I PLANKTON ZAREGULIROVANNYKH VODOEMOV.) *Gigiena Vodokhranilishch* 127-132; Referat. Zhur., Biol., 1962, No. 11Zh354; Biological Abstracts, Vol. 41, No. 6, Abst. No. 21511. 1963.

In new reservoirs, in the first year of their

existence, only Polygonum amphibium and Elodea grow; later, filamentous algae and other plants appear. The rapid overgrowth of reservoirs is promoted by the flooding of forests, undergrowth, and stumps left behind after filling of the basin of the reservoirs. Macrophytes affect the physical and chemical qualities of the water--its transparency, coloration, and smell; serve as a barrier to the entrance of dispersed suspended matter (impurities); play an important role in determining oxygen conditions. The wide distribution of macrophytes prevents the development of phytoplankton. The dominant organisms in the phytoplankton complex are diatomaceous algae in the spring and autumn, and blue-green and protococcid algae in the summer. There is an antagonistic relationship between saprophytic bacteria and algae. Photosynthesis is one of the factors in the self-purification of reservoirs. Abundant growth of phytoplankton leads to the pollution of the purifying installations of reservoirs. Overgrowth of reservoirs should be controlled by removal of forest plantings and undergrowth from the bed, by adherence to the work plan and cooperation in the operation of the reservoirs (freezing, drying), stopping the discharge of waste water, removing algae during blooming with water-pipe cleaning installations.

5790. Frear, Donald E. H. 1962. PESTICIDE HANDBOOK 1962. 14th ed. College Sci. Publishers: State College, Pennsylvania, 303 pp.; Biological Abstracts, Vol. 41, No. 6, Abst. No. 24888. 1963.

This edition contains 9444 commercial pesticide products, an increase of approximately 5% over the number listed in 1961. It is divided into three sections. In section I, all trade names are listed alphabetically, without regard for the type of product. Each product has been given a code number which serves to identify the individual products listed in Sections II and III. Section II lists all products according to use (fungicides, insecticides, etc.). In section III the names of all manufacturers are arranged in alphabetical order followed by code numbers of the products manufactured by each of them.

5791. Bauzá Rulián, Juan. 1961. CONTRIBUTIONS TO THE KNOWLEDGE OF THE OTOLITHS OF RECENT FISHES. (CONTRIBUCIONES AL CONOCIMIENTO DE LOS OTOLITOS DE PECES ACTUALES.) Bol. Real Soc. Española Hist. Nat. 59(2): 153-168; Biological Abstracts, Vol. 41, No. 6, Abst. No. 25110. 1963.

The otoliths of the following spp. are described: Scomber scombrus, Seriola dumerili, Sarda sarda, Maena vulgaris, Serranus atricauda, Gobius minutus, Lophius piscatorius, L. budegassa, and Corvina nigra. (A. K. W.)

5792. McAllister, D. E. (Natl. Mus. Canada, Ottawa, Ontario, Canada). 1962. THE BRASSY MINNOW, RIVER SHINER AND SAUGER NEW TO ALBERTA. Canadian Field-Nat. 76(2): 124-

125; Biological Abstracts, Vol. 41, No. 6, Abst. No. 25114. 1963.

Hybognathus hankinsoni was collected at Lodge Creek on highway 48, Notropis blennius and Stizostedion canadense at Morrin, constituting the first records for Alberta and bringing the known native species of fish to 39. Specimens of Etheostoma exile lacking the usual opercular and cheek scales are described.

5793. Caldwell, Melba C. (Bur. of Comm. Fish., Washington, D. C.). 1962. DEVELOPMENT AND DISTRIBUTION OF LARVAL AND JUVENILE FISHES OF THE FAMILY MULLIDAE OF THE WESTERN NORTH ATLANTIC. U. S. Fish and Wildlife Service, Fishery Bulletin 213, Vol. 62, 55 pp.

The young of the four species of goatfish (Mullidae) of the western North Atlantic are discussed morphologically, meristically, and ecologically, and developmental changes are described and illustrated.

Pseudupeneus maculatus (smallest, 18.5 mm.) is shown to have an early offshore pelagic stage which differs in appearance from the adult inshore bottom-dwelling stage. The data indicate that, within limits, the change in habitat initiates the metamorphosis, rather than metamorphosis occurring at a specific size. More limited data for Mullus auratus (smallest, 8.2 mm.) and Upeneus parvus (smallest, 20.8 mm.) suggest a similar life cycle. Nothing is known of Mulloidichthys martinicus below 82.5 mm.

The range of U. parvus is extended northward to North Carolina and southward to Vitoria, Brazil. M. martinicus (possibly market-procured) from as far south as Salvador, Brazil, were examined.

Mullus auratus, previously described as having no teeth in the upper jaw, are shown to have teeth as juveniles, which become obsolete with maturity.

Two keys are given, the first for specimens 10.0 through 82.5 mm., the second for larger specimens. (Auth.)

5794. Iversen, Robert T. B. (Bur. of Comm. Fish., Biol. Lab., Honolulu, Hawaii). 1962. FOOD OF ALBACORE TUNA, THUNNUS GERM (LACÉPÈDE), IN THE CENTRAL AND NORTHEASTERN PACIFIC. U. S. Fish and Wildlife Service, Fishery Bulletin 214, Vol. 62, 23 pp.

The stomach contents of 544 albacore tuna, Thunnus germ (Lacépède), captured during the years 1950-57 were analyzed in order to identify the organisms eaten, to determine if the abundance and distribution of albacore is related to the abundance and distribution of their food, and to relate feeding to size, method of capture, geographic location, season, distance from land, time of day, and water clarity.

Stomach contents were mainly a variety of fish, squid, and crustaceans, the percent volume of each differing according to the method of capture.

The latitudinal abundance of albacore in the equatorial Pacific was not related to the amount of

food eaten. During the summer in the temperate North Pacific, high stomach volumes were found south of successive peak volumes of organisms captured by midwater trawling and zooplankton tows. This suggests successive trophic levels associated with an advancing oceanographic and biological "frontier" in the Transition Zone. There was little seasonal difference in food volumes. Reef-associated organisms appeared most frequently in the diet of albacore caught near land.

Troll-caught albacore in the North Pacific fed throughout the day, but evidence of distinct feeding periods was not clear. There is evidence that albacore also feed at night. The higher stomach volumes of troll-caught albacore occurred in waters of midclarity. Some competition for food may exist among albacore, yellowfin, and bigeye tuna in the equatorial Pacific. (Auth.)

5795. King, Joseph E. (Bur. of Comm. Fish., Washington, D. C.), and Robert T. B. Iversen. 1962. MIDWATER TRAWLING FOR FORAGE ORGANISMS IN THE CENTRAL PACIFIC, 1951-1956. U. S. Fish and Wildlife Service, Fishery Bulletin 210, Vol. 62, 51 pp.

Collections from 274 midwater trawl hauls made in the central Pacific Ocean by the Bureau of Commercial Fisheries during the years 1951 through 1956 were analyzed quantitatively to obtain estimates of the abundance and distribution of forage organisms. Occurrence of these organisms in the trawl catches was compared with the occurrence of similar organisms in the stomachs of yellowfin, bigeye, skipjack, and albacore tunas taken by longline, surface trolling, and pole-and-line fishing.

The largest catches by the Isaacs-Kidd trawls were made in the Aleutian Current and in the region of upwelling at the Equator, and the poorest catches south of latitude 5° S. in the North Equatorial Current between latitudes 10° N. and 18° N., and in Hawaiian waters. The greatest variety of organisms occurred in catches made in the South Equatorial Current and in the Countercurrent.

There was poor correspondence between the composition of trawl catches and the contents of tuna stomachs, since most trawl hauls were made at night and the fishing which provided the tuna stomachs occurred in the daytime. There was marked diurnal variation in the trawl catches. Night hauls produced catches larger in volume, number, and size of organisms. Diurnal differences in composition of the trawl catches were striking.

Trawl catch volumes were correlated with various environmental factors and found to be more closely related to zooplankton than to inorganic phosphate or to the uptake of C¹⁴ by phytoplankton. (Authors)

5796. Kuehne, Robert A. (Dept. of Zool., Univ. of Kentucky, Lexington). 1962. A CLASSIFICATION OF STREAMS, ILLUSTRATED BY FISH DISTRIBUTION IN AN EASTERN KENTUCKY

CREEK. Ecology, Vol. 43, No. 4, pp. 608-614.

Weaknesses exist in the ecological classifications of the lotic series. Essentially, streams are broken into a multitude of small habitats or communities. Each unit can be treated by itself, but the units cannot be summed to give the picture of a river. Ecological classifications offer unsatisfactory frameworks for comparing different watersheds.

Geologists usually classify rivers on the basis of aerial pattern. Ultimate headwaters are considered to be Order 1, and the union of 2 such units forms an Order 2 segment. When 2 streams of equal order join, they form a segment of the next highest order. Rank is not increased by the entrance of lower order units. The classification can be determined from maps and furnishes an objective framework both for single stream and comparative studies.

Spring-fed streams, distributaries, incipient drainages and trellace basins may not fit the classification perfectly. Discrepancies of one rank are possible in determining order, even when good maps are used.

Buckhorn Creek fish collections fit the system well, showing progressive increase in average numbers of species as stream order increases. Within orders, species composition, gradients and probably food chains are comparable. (Auth.)

5797. Schelske, Claire L. (Bur. of Comm. Fish. Biol. Lab., Beaufort, North Carolina), Frank F. Hooper, and E. J. Haertl. 1962. RESPONSES OF A MARL LAKE TO CHELATED IRON AND FERTILIZER. Ecology, Vol. 43, No. 4, pp. 646-653.

An experiment was performed to determine the effect of chelated iron (iron sodium salt of N-hydroxyethylethylenediamine triacetic acid) and commercial fertilizer on the primary productivity of a 14-acre marl lake in Grand Traverse County, Michigan. Rates of C¹⁴ uptake by phytoplankton were measured at a selected series of depths to determine effects of the lake treatments. After the addition of chelated iron, C¹⁴ uptake per unit surface area increased approximately 4-fold over the rate during a pretreatment (control) period. Increases in the rate of C¹⁴ uptake were detected only in strata treated with chelated iron. Fertilizer was added to the experimental lake 10 days after the addition of chelated iron. This increased the rate of C¹⁴ uptake per unit surface area approximately 60 times over the rate during the control period.

Only fertilizer was added to a 2nd marl lake (a reference or control lake). The addition of fertilizer did not increase the rate of C¹⁴ uptake greatly in comparison to the increase found in the experimental lake.

Phosphorus remained in the water longer after fertilization of Sand Lake 1, the lake treated with chelated iron, than in Sand Lake 2. In Sand Lake 1 much of the added iron remained in the epilimnion until the onset of a phytoplankton bloom that developed after fertilization. The phytoplankton bloom

removed iron from the water, reducing the iron content of the lake far below the pretreatment level. Apparently the chelate molecule made iron available to the phytoplankton that was not available previously.

The effects of the lake treatments and changes in the rates of C^{14} uptake are considered in relation to the vertical distributions of total iron, total phosphorus, and dissolved oxygen. (Authors)

5798. Jeffries, Harry P. (Narragansett Marine Lab., Univ. of Rhode Island, Kingston). 1962. COPEPOD INDICATOR SPECIES IN ESTUARIES. Ecology, Vol. 43, No. 4, pp. 730-733.

Flushing of Raritan Bay, N. J., is accomplished by regional inequalities in the duration and strength of 2 net tidal drifts--a net flood current directed into the estuary along its northern shore and a net ebb flowing oceanward along the southern shore. Over a period of 15 months, occurrences of 8 non-indigenous copepod species paralleled this pattern. Frequencies of occurrence and abundances were largest at stations on the course of the net flood drift, indicating that periodic influxes from propagation areas in Lower Bay, the oceanward half of the estuary, and its offings maintained the 8 species in Raritan Bay. Relative frequency of occurrence for all 8 copepods in the flood area was 22% greater than in the net ebb sector. It appears that the indicator species concept, usually regarded in terms of distributions encompassing hundreds of miles in the ocean, can be applied to estuarine circulation over ranges of but a mile or so. (Auth.)

5799. Hubbs, Clark, and Neal E. Armstrong (Dept. of Zool., The Univ. of Texas, Austin). 1962. DEVELOPMENTAL TEMPERATURE TOLERANCE OF TEXAS AND ARKANSAS-MISSOURI ETHEOSTOMA SPECTABILE (PERCIDAE, OS-TEICHTHYES). Ecology, Vol. 43, No. 4, pp. 742-744.

Orangethroat darters from a northern population (Arkansas-Missouri) survive higher developmental temperature maxima than do those from a southern population (central Texas). During the breeding season the environmental temperature is similar; however, the temperature is increasing more rapidly in Arkansas and Missouri. Therefore eggs and larvae are exposed to higher temperatures in the north. (Authors)

5800. Gordon, Malcolm S. (Dept. of Zool., Univ. of California, Los Angeles). 1963. CHLORIDE EXCHANGES IN RAINBOW TROUT (SALMO GAIRDNERI) ADAPTED TO DIFFERENT SALINITIES. The Biological Bulletin, Vol. 124, No. 1, pp. 45-54.

Estimates of rates of exchange of body chloride, both total exchanges and exchanges across the integument and by way of the gut and kidneys, have been made in rainbow trout Salmo gairdneri acclimatized to various salinities between fresh water and sea water (salinity 32 0/00. Radioactive chlorine-36 was used as a tracer of chloride

movements.

Neither total Cl exchanges nor integumentary exchanges varied in proportion with changes in the magnitude of the transintegumentary osmotic gradients maintained by the fish. This result is interpreted as indicating that changes in the permeability to water of the integument (probably primarily the gills) are an important part of the salinity adaptation process in rainbow trout.

Laboratory diuresis and exchange diffusion of chloride are discussed as possible complications, in this interpretation. (Auth.)

5801. Mansueti, Romeo J. (Nat. Resources Inst. of the Univ. of Maryland, Solomons), and Edgar H. Hollis. 1963. STRIPED BASS IN MARYLAND TIDEWATER. Nat. Res. Inst., Univ. of Maryland, Educ. Ser. No. 61, 23 pp.

A summary of 10 years of research at the Chesapeake Biological Laboratory, Solomons, Maryland. Includes discussions on reproduction, age and growth, food habits, migration, harvest and management. Eighty references are listed.

5802. Thorsteinson, Fredrik V., Wallace H. Noerenberg, and Howard D. Smith (Fish. Research Inst., Coll. of Fish., Univ. of Washington, Seattle). 1963. THE LENGTH, AGE, AND SEX RATIO OF CHUM SALMON IN THE ALASKA PENINSULA, KODIAK ISLAND, AND PRINCE WILLIAM SOUND AREAS OF ALASKA. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 430, 84 pp.

Data on length, age, and sex ratio of chum salmon from the Alaska Peninsula area from 1951 through 1957, the Kodiak Island area from 1948 through 1951 and 1955 through 1957, and the Prince William Sound area from 1952 through 1958 show that age and length composition in these areas varied in a similar manner. Lengths of fish in the 3-, 4-, and 5-year age classes overlapped to such an extent that length was not a useful guide to age. The average age composition for the combined samples was about 10 percent 3-year-olds, 75 percent 4-year-olds, and 15 percent 5-year-olds. Mean age decreased as the season advanced. The percentage of males decreased slightly as the runs progressed. (Authors)

5803. McConnell, William J. (Arizona Cooperative Wildl. Research Unit., Univ. of Arizona, Tucson). 1963. PRIMARY PRODUCTIVITY AND FISH HARVEST IN A SMALL DESERT IMPOUNDMENT. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 1-12.

Centrarchid harvest was compared to gross photosynthesis in a small desert impoundment. Average annual gross photosynthesis for benthic plants and plankton was equal to 14,100 pounds per acre (1.6 kg/m²) of oxygen or primary photosynthate over a 3-year period. Average annual harvest of centrarchids (largemouth bass and black crappie) was 138 pounds per acre live weight, which is equal to 0.98 percent of gross photosynthesis. Considered

as dry biomass, centrarchid harvest equaled 0.15 percent of gross photosynthesis. When examined with regard to degree of habitat exploitation by centrarchids, fishing intensity, population turnover, competition from other fish, and cycles of recruitment, harvest of centrarchids was judged to be near the potential maximum. By the same standards, however, channel catfish production and harvest were judged to be considerably lower than what might be achieved with more effective recruitment and fishing. For the foregoing reason the relation between total fish harvest (channel catfish plus centrarchids) and gross photosynthesis was not considered to be valid for making total harvest predictions based on knowledge of gross photosynthesis. Possible effects on interpretation of gross photosynthesis of photic depth, organic import, dominant producer of plants, and deferred entry of plant forage into the food chain are discussed. Precision of estimate of major elements used in computing the harvest/photosynthesis ratio is also considered. (Auth.)

5804. Olson, Donald E., and Warren J. Scidmore (Minnesota Dept. of Cons., St. Paul). 1963. HOMING TENDENCY OF SPAWNING WHITE SUCKERS IN MANY POINT LAKE, MINNESOTA. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 13-16.

Recapture of marked adult white suckers *Catostomus commersoni* showed evidence of homing to specific spawning sites at Many Point Lake in northern Minnesota. The pattern of recaptures also indicated a recurring time pattern for return of individual fish, some fish consistently returning to spawning sites earlier in the spawning run than others. (Authors)

5805. Kiser, R. W. (Centralia Coll., Centralia, Washington), John R. Donaldson, and Paul R. Olson. 1963. THE EFFECT OF ROTENONE ON ZOOPLANKTON POPULATIONS IN FRESHWATER LAKES. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 17-24.

Though the use of rotenone is a common procedure in freshwater fishery management, little is known of its effect on zooplankton. Fern Lake, a shallow dystrophic lake in western Washington, was treated with 0.5 ppm of 5 percent rotenone powder in June 1960. Biweekly sampling of the open water, shore edge, and marsh area prior to and for 6 months following treatment provided quantitative and qualitative measurements of zooplankton populations. Open-water species were completely removed, and remained absent for over 3 months. Organisms along the shore edge resisted the effect of rotenone, but eventually disappeared for several weeks. Those species inhabiting the dense weed patches did not all succumb to rotenone. The rare appearance of large numbers of males and usually early ephippial-egg-bearing female Cladocera were observed.

Silver Lake, another shallow, dystrophic lake, was treated with 1 ppm of rotenone in September

1960, and an immediate effect on the zooplankton populations was observed. The rotenone penetrated to the thermocline at the 30-foot depth in the first 6 hours, killing Cladocera and Copepoda as it sank.

A most significant observation for fishery management was the length of time that zooplankton, organisms important as fish food, were absent from the lake. Preapplication zooplankton populations were not established until several months after the lakes had become nontoxic to fish and had been restocked. (Authors)

5806. Isaac, Gary W., and Carl E. Bond (Oregon State Univ., Dept. of Fish and Game Mgmt., Corvallis). 1963. STANDING CROPS OF FISH IN OREGON FARM PONDS. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 25-29.

Standing crops of fish in representative Oregon farm ponds were estimated by marking and recapture or by draining and enumeration. Most of the ponds were in the Willamette Valley, but a few were in central and southern Oregon. The average standing crop of bluegills *Lepomis macrochirus* was about 130 pounds per acre, and was similar to standing crops reported by workers in other states. The average standing crop of largemouth bass *Micropterus salmoides* for 12 ponds was 104 pounds per acre. Central Oregon ponds appeared to support more pounds of bass per acre than western Oregon ponds.

Rough-skinned newts *Taricha granulosa granulosa* were present in large numbers in some Willamette Valley ponds, with standing crops up to 245 pounds per acre. This species is believed to be an important competitor for food in fish ponds. (Authors)

5807. Poole, Richard L. (California Dept. of Fish and Game, Menlo Park), Donald R. Kuester, and Arthur Witt, Jr. 1963. THE STATUS OF SPEARFISHING AND THE USE OF SCUBA IN FISH MANAGEMENT PROGRAMS IN THE FRESHWATERS OF THE UNITED STATES. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 30-33.

This paper is based on a questionnaire which was answered by the fishery departments of each of the United States except Alaska and Hawaii. There was an increase in the number of states that permit general underwater spearfishing; from 42 percent in 1957 to 73 percent in 1960. Over 30 species classified as rough fish could be speared legally in states that allowed spearfishing in 1960. Limits were liberal, the spearfishing season was generally unrestricted, and only three states required spearfishermen to have special licenses. Fourteen states had various kinds of restrictions on the types of impaling devices used by spearfishermen; i. e., explosive guns, spring- and rubber-operated guns, or hand-held spears. Eleven states indicated that illegal activities by divers were or threatened to become law enforcement problems.

In 1957, 14 states used SCUBA in their management programs; in 1960, 21 states used SCUBA, and

13 states planned to use it in the future. The various ways in which SCUBA is being used in state fisheries programs are summarized. (Authors)

5808. Allison, Leonard N. (Inst. for Fish. Res., Michigan Dept. of Cons., Grayling). 1963. CATARACT IN HATCHERY LAKE TROUT. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 34-38.

In 1957, when control of the sea lamprey appeared imminent, production of lake trout Salvelinus namaycush in hatcheries was increased. Coincident with this increase, certain diseases of lake trout became evident. One disease, cataract, results in permanent damage to the eye.

Several experiments to investigate the cause of cataract were conducted over a period of 3 years; 3 with diets, 3 involving light intensity (Allison, 1962), 1 handling, and 1 experiment with injections of excess riboflavin. The experiments with diet, handling, and riboflavin injections did not provide control of cataract. (Auth.)

5809. Reimers, Norman (Bur. of Sport Fish. and Wildl., Bishop, California). 1963. BODY CONDITION, WATER TEMPERATURE, AND OVER-WINTER SURVIVAL OF HATCHERY-REARED TROUT IN CONVICT CREEK, CALIFORNIA. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 39-46.

Catchable-sized, hatchery-reared rainbow trout Salmo gairdneri undergoing survival tests in controlled sections of a mountain stream repeatedly declined in coefficient of condition for several months after being stocked. Examples of the extent of this decline, together with records of stream temperatures and associated mortality are used to demonstrate the relationship among poor body condition, rising temperature, and breakdown of trout vitality during the critical late-winter period. Possible advantages of fall stocking and of breeding some hatchery trout for superior adaptability are discussed. (Auth.)

5810. Forney, John L. (Dept. of Cons., Cornell Univ., Ithaca, New York). 1963. DISTRIBUTION AND MOVEMENT OF MARKED WALLEYES IN ONEIDA LAKE, NEW YORK. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 47-52.

Movements of three spawning populations of walleyes Stizostedion vitreum vitreum are described from 1,174 tag recoveries reported by anglers, and from additional recoveries in experimental fishing gear. Most walleyes returned to the same spawning area in successive years. The Scriba Creek spawning population showed a gradual dispersal from the spawning area in May and June, and the population attained its widest distribution in late summer. Although the three spawning populations intermingled during summer, differences in the summer distributions of the populations were evident. Marking during the fall suggested that

most walleyes remained in a limited area except during the spawning period. The Oneida Lake data demonstrate that widely distributed recoveries of walleyes tagged at one spawning site in a lake do not constitute satisfactory evidence of population homogeneity. (Auth.)

5811. Latta, William C. (Inst. for Fish. Res., Michigan Dept. of Cons., Vanderbilt, Michigan). 1963. SEMI-ANNUAL ESTIMATES OF NATURAL MORTALITY OF HATCHERY BROOK TROUT IN LAKES. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 53-59.

Mark-and-recapture estimates of the number of hatchery-reared brook trout Salvelinus fontinalis have been made each April and October since October 1956 in Ford Lake (10 acres) and Hemlock Lake (6 acres), at the Pigeon River Trout Research Station, Vanderbilt, Michigan. Fish were recaptured by angling, by trapping with wire traps, and by shocking with direct current at night with underwater lights. A permit-type creel census insured a nearly complete record of the catch.

Instantaneous mortality rates and conditional mortality rates were calculated for each year class. The largest natural loss of trout occurred during the first summer after planting. The rate of natural mortality during summer decreased with a decrease in the number of trout present each spring. Over-winter loss was negligible. The causes of the mortality are unknown. (Auth.)

5812. Lewis, William M., and Sue D. Lewis (Fish Pathology Lab., Southern Illinois Univ., Carbondale). 1963. CONTROL OF EPIZOOTICS OF GYRODACTYLUS ELEGANS IN GOLDEN SHINER POPULATIONS. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 60-62.

Under hatchery conditions Gyrodactylus elegans is one of the principal parasites of the golden shiner. It becomes epizootic in the spring at temperatures of 40 to 60° F. It spreads rapidly and causes pronounced mortality. The operational procedure in shiner hatcheries requires both pond and tank treatment. For pond treatment 25 ppm formalin gives excellent control. In tanks 50 ppm for 14 hours gives satisfactory control. (Authors)

5813. Parisot, Thomas J., William T. Yasutake (Western Fish Disease Lab., Seattle, Washington), and Vernon Bressler. 1963. A NEW GEOGRAPHIC AND HOST RECORD FOR INFECTIOUS PANCREATIC NECROSIS. Transactions of the American Fisheries Society, Vol. 92, No. 1, pp. 63-66.

The occurrence of infectious pancreatic necrosis in rainbow trout Salmo gairdneri, brook trout Salvelinus fontinalis, and cutthroat trout Salmo clarki has been experimentally authenticated for the first time in the western United States. The cutthroat trout represents a new host. Brook trout fin tissue culture inoculated with bacteria-free filtrate from the diseased fish tissue showed marked degenerative changes after 24 hours. Chinook salmon Oncorhynchus tshawytscha, kokanee O. nerka, and silver

salmon O. kisutch were not susceptible to the virus when inoculated. Histologically, extensive pancreatic necrosis was observed in the original and experimental materials, but striated muscle hyalinization was detected only in the original material. (Authors)

5814. Paloheimo, J. E., and L. M. Dickie (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, N. B., Canada). 1962. SAMPLING THE CATCH OF A RESEARCH VESSEL. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 1, pp. 13-25.

The sampling procedure commonly used on board research vessels in which catches are sorted by species and picked up into baskets was examined in catches containing several species, principally haddock. The procedure does not appear to permit withdrawal of random samples for lengths or counts of fish. Mixing these basket lots results in sample units which are effectively homogeneous for length composition and reduces the amount of sampling necessary to estimate numbers of fish caught. However, mixing does not appear to be effective if the species sort is omitted, especially in large catches. (Authors)

5815. McPHAIL, J. D. (Dept. of Zool., McGill Univ., Montreal, Quebec, Canada). 1963. GEOGRAPHIC VARIATION IN NORTH AMERICAN NINESPINE STICKLEBACKS, PUNGITIUS PUNGITIUS. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 1, pp. 27-44.

Ventral spine length and the number of lateral plates, dorsal spines, and gill rakers in Pungitius pungitius from 132 North American localities were compared. The number of lateral plates is consistently high in populations from tidal waters, and low in inland populations. Geographic variation in the number of dorsal spines and gill rakers suggest two allopatric forms of P. pungitius in North America. A Bering form ranges from Alaska along the arctic coasts of Canada, and a Mississippi form ranges from the Great Lakes to the Mackenzie River. Two glacial refugia are hypothesized to explain the origin and present distribution of these forms. (Auth.)

5816. McBride, J. R., U. H. M. Fagerlund, M. Smith, and N. Tomlinson (Fish. Res. Bd. of Canada, Technol. Sta., Vancouver, B. C., Canada). 1962. RESUMPTION OF FEEDING BY AND SURVIVAL OF ADULT SOCKEYE SALMON, ONCORHYNCHUS NERKA, FOLLOWING ADVANCED GONAD DEVELOPMENT. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 1, pp. 95-100.

Adult, migrating, fasting sockeye salmon, Oncorhynchus nerka, were held in captivity in fresh water without spawning well beyond the time when they would normally have done so and died. A few fish were gonadectomized and force feeding was begun. A few unoperated fish were fed similarly while the remainder served as unoperated, unfed controls. The gonads of the operated fish were

well developed. After a period of feeding of about four months some fish in each group had survived. The fed fish had regained their green color and much of their weight and vigor, while the surviving unfed fish were extremely emaciated and listless. At this time voluntary feeding by the force-fed fish was observed for the first time, and it was then found that the five surviving unfed controls would also take food voluntarily. While two of these fish died without apparent improvement in their condition, the other three gradually regained green color, weight and vigor. (Authors)

5817. Tsuyuki, H., and E. Roberts (Fish. Res. Bd. of Canada, Technol. Sta., Vancouver, B. C., Canada). 1962. SPECIES DIFFERENCES OF SOME MEMBERS OF SALMONIDAE BASED ON THEIR MUSCLE MYOGEN PATTERNS. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 1, pp. 101-104.

The muscle myogen patterns obtained by starch gel electrophoresis of the Dolly Varden and eastern brook trout, Salvelinus, the rainbow and steelhead trouts and the Atlantic salmon, Salmo, and the coho, spring, chum, sockeye and pink salmon, Oncorhynchus, are compared. The myogen protein patterns are clearly distinct for each species of fishes studied, except for the rainbow and steelhead trouts, and constitute a remarkably constant property which can be employed to differentiate between species and for other useful purposes. The specific and generic inter-relationships have been analyzed by these patterns and developed as further criteria for classification purposes and are discussed in conjunction with currently accepted beliefs. (Authors)

5818. Gee, J. H. (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, N. B., Canada). 1962. COMPARATIVE ECOLOGY OF TWO SYMPATRIC SPECIES OF DACE (RHINICHTHYS) IN THE FRASER RIVER SYSTEM, BRITISH COLUMBIA. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 1, pp. 105-118.

Age, growth and food habits of leopard dace, Rhinichthys falcatus, in the lower Fraser River are described. Although recently emerged leopard dace and longnose dace, Rhinichthys cataractae, occur together in regions of slow or no current along the river margin, older longnose dace soon begin to occupy regions of higher water velocity. Yearling and older leopard dace remain predominantly in areas of little current. Laboratory experiments in a stream tank demonstrate a strong current preference in longnose dace fry, yearlings and adults. Leopard dace of comparable size show no preference for water current. The swimbladder volume of yearling and adult longnose dace is much lower than that of leopard dace, possibly an adaptation of the former species to occupation of riffle habitat. Temporary coexistence of the two closely related species in the same niche is discussed briefly. (Authors)

5819. Garrod, D. J. (Fish. Lab., Lowestoft, England). 1962. AN ESTIMATION OF THE

MORTALITY RATES IN A POPULATION OF *TILAPIA ESCULENTA* GRAHAM (PISCES, CICHLIDAE) IN LAKE VICTORIA, EAST AFRICA. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 1, pp. 195-227.

In the commercial fisheries of the great lakes of Central Africa the nylon gill net is the most widespread type of gear in use at present. Recent increases in fishing effort are believed to have had a marked effect upon the abundance of some species and this paper describes a method of estimating the fishing mortality from a fishery of this type. The method is demonstrated in its application to a population of *Tilapia esculenta* in Lake Victoria. In particular the data from the gill net fishery are combined with the known selectivity of the gear to distinguish between fishing mortality and trends in natural loss from the population with increasing age of the fish. The study also shows that the population dynamics of a tropical fish species are amenable to conventional techniques of analysis. (Auth.)

5820. Matsui, Yoshiichi (Fish. Inst., Fac. of Agr., Kinki Univ., Osaka, Japan). 1962. **ON THE RAINBOW TROUT (*SALMO GAIRDNERII IRIDEUS*) IN LAKE TITICACA, SOUTH AMERICA.** Bulletin of the Japanese Society of Scientific Fisheries, Vol. 28, No. 5, pp. 497-498.

Lake Titicaca is a fresh-water lake situated in Peru and Bolivia, is 222 kilometers long and 113 kilometers wide. Its total area, including its 36 islands, is about 9065 square kilometers. It is the highest navigable lake in the world, the surface of its water is 3812 meters above sea level. It is fed by 25 rivers and streams which draw their waters from the snow of the mountains that fringe it. Its only outlet is the one river of Desaguadero in the south. Its maximum depth is 370 meters. The surface water temperature was 14° - 16° C in April, 1961.

Salmo trutta fario, *Salmo gairdnerii irideus*, *Salvelinus fontinalis fontinalis*, and *Salvelinus namaycush* have been transplanted from the United States and Chile. They have achieved phenomenal size, especially *Salmo gairdnerii irideus*. The largest one recorded is 1.22 meters long and weighs 22.7 kilograms. (Auth.)

5821. Louder, Darrell E. (North Carolina Wildl. Resources Comm., Raleigh). 1962. **AN ANNOTATED CHECK LIST OF THE NORTH CAROLINA BAY LAKES FISHES.** The Journal of the Elisha Mitchell Scientific Society, Vol. 78, No. 1, pp. 68-73.

The last publication on the fishes of the North Carolina bay lakes was written by David G. Frey in his publication "The Fishes of North Carolina's Bay Lakes and their Intraspecific Variation", which was published in 1951 in the *Journal of the Elisha Mitchell Scientific Society*. At that time thirty-one species of fishes had been taken from the lakes, three being endemic to Lake Waccamaw. At the present writing there are 16 families, 27 genera, and 39 species known from the lakes, with an

increase in known numbers of fish species from four of the lakes. (Auth.)

5822. Pasztor, Valerie (Dept. of Zool., McGill Univ., Montreal, Canada), and H. Kleerekoper. 1962. **THE ROLE OF THE GILL FILAMENT MUSCULATURE IN TELEOSTS.** Canadian Journal of Zoology, Vol. 40, No. 5, pp. 785-802.

The gill filament musculature of several fresh-water teleosts was studied using visual and oscillographic methods. Continual activity was observed in the small muscles connecting the two hemibranch rows on each gill arch in all the fish examined. In those fish where the gill filament rows are bound together by a sheet of connective tissue, there was an additional active series of muscles situated on the oral surface of each gill arch. Both series of muscles contracted once every breathing cycle whether the fish was in water or in air.

It is proposed that these muscles have two important functions. Firstly, they assist in maintaining an even spacing of the gill hemibranchs at all phases of the breathing cycle, thus insuring that all the lamellae receive adequate ventilation. Secondly, they take part in a regulatory mechanism which controls the amount of water which will be presented to the respiratory surfaces of the lamellae. (Authors)

5823. Saunders, Richard L. (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, N. B., Canada). 1962. **THE IRRIGATION OF THE GILLS IN FISHES. II. EFFICIENCY OF OXYGEN UPTAKE IN RELATION TO RESPIRATORY FLOW ACTIVITY AND CONCENTRATIONS OF OXYGEN AND CARBON DIOXIDE.** Canadian Journal of Zoology, Vol. 40, No. 5, pp. 817-862.

Respiratory volumes, percentage utilizations of oxygen, and rates of oxygen consumption were measured in non-swimming and swimming white suckers, brown bullheads, and carp under various ambient levels of oxygen and carbon dioxide. Up to 85% of the oxygen in the inspired water is removed by quietly breathing fish. Generally, high respiratory volumes are associated with low percentage utilizations of oxygen and vice versa. At high respiratory volumes carp remove about twice as much oxygen from the inspired water as do suckers and bullheads. Respiratory volumes are increased by as much as 30 times over the volume for quiet respiration by low levels of oxygen or high levels of carbon dioxide. Respiratory volumes of swimming fish are greater than those of non-swimming, rested fish in air-saturated water but they are not as high as those of non-swimming fish exposed to low ambient oxygen levels.

The effects of moderate increases in ambient carbon dioxide on non-swimming fish may be temporary only. If the rise in the $p\text{CO}_2$ is slight to moderate, the percentage utilizations of oxygen at given respiratory volumes are at first depressed but may return, after 3 to 5 hours, to the levels they held before the $p\text{CO}_2$ was raised. Actively swimming fish respond to any increase in the $p\text{CO}_2$ by permanently increased breathing rates and

decreased percentage utilizations of oxygen and rates of oxygen consumption.

The number of respiratory units or lamellae per millimeter of gill filament in suckers, bullheads, and carp weighing 200 g are about 14, 10, and 20 respectively, but the total numbers and areas of lamellae are such that total gill areas are nearly identical among these three species. (Auth.)

5824. Müller, K. 1962. STUDIES ON LIMNOLOGY AND FISH BIOLOGY IN REGULATED WATERS OF SWEDISH LAPPLAND. *Oikos*, 13, 125-154; *Water Pollution Abstracts*, Vol. 35, No. 12, Abst. No. 2299. 1962.

The author discusses the effect of river regulations on the aquatic fauna in the Stora Lule River, Sweden, which has been affected by the operation of the Suorva Reservoir since 1927, and compares it with conditions in the natural river system of the Lilla Lule. The damming up of snow and melting glacier waters affects the temperature of the river, interfering with the normal life of the organisms. Studies at the power dam at Selsforsen showed that by taking plankton-rich surface water below such dams, a rich bottom fauna can live in the river. (Auth.)

5825. Timmermans, J. A. 1962. ESTIMATION OF THE DAMAGE TO FISHERIES CAUSED BY POLLUTION. *Trav. Sta. Rech. Groenendaal*, Ser. D., No. 34, 36 pp.; *Water Pollution Abstracts*, Vol. 35, No. 12, Abst. No. 2392. 1962.

Examples are given of the estimation of the damage to fisheries caused by pollution to determine the necessary remedial action, in the case of breeding ponds, fishponds, trout streams and mixed-fishing streams. It is pointed out that the methods quoted can serve only as a guide in solving similar problems, since each case has its own peculiarities and must be considered individually.

5826. Maldura, C. 1961. PRELIMINARY RESEARCH ON THE ACTION OF ALKYLARYLSULPHONATE ON *SALMO IRIDEUS*. *Proc. Gen. Fish. Coun. Medit.*, 6, 203-206, *Tech. Pap.* No. 25; *Water Pollution Abstracts*, Vol. 35, No. 12, Abst. No. 2407. 1962.

The results of preliminary experiments on the effect of alkylarylsulphonates on rainbow trout (*Salmo irideus*) are tabulated and discussed briefly. It was found that eggs survived in detergent solutions for several days. Alevins and young fish placed in the detergent solution exhibited rapid erratic movements and increased respiration, then later floated on their side before death. Newly hatched alevins were more resistant than those in which the yolk sac was being absorbed, but after the sac was completely absorbed resistance increased with age. The toxicity of the detergent was affected by several factors, and further work is to be done on this problem.

5827. Overbeek, J. V. (Shell Oil Company). 1962. METHOD OF CONTROLLING AQUATIC PLANTS.

U.S.P. 2,959,476; *Water Pollution Abstracts*, Vol. 35, No. 12, Abst. No. 2410.

It is claimed that acrolein, in doses of not less than 1 ppm, and not more than 10,000 ppm, can be used in bodies of water such as canals, rivers, lakes, and irrigation systems, to control undesirable aquatic life such as submerged water weeds and water snails. Although it is most effective for controlling algae and completely submerged plants, it is also effective for controlling floating plants. The main advantages claimed are that its herbicidal efficiency lasts for extended periods of time and over remarkably long distances, up to 15 miles or more, so that the water can be treated some distance from the submerged flora; terrestrial plant life is unaffected; and the aquatic life is not only killed but also disintegrated so that it does not cause clogging. The optimal dose of acrolein is considered to be 20-50 ppm. The herbicide is somewhat more effective in warm weather. In fast-flowing water the dose must be increased because the weeds are bent, causing channelling which may prevent efficient contact with the herbicide.

5828. Schaefer, M. B. 1961. SOME FUNDAMENTAL ASPECTS OF MARINE ECOLOGY IN RELATION TO RADIOACTIVE WASTES. *Hlth. Phys.*, 6, Nos. 3/4, 97-102; *Publ. Hlth. Engng. Abstr.*, 1962, 42, 76; *Water Pollution Abstracts*, Vol. 35, No. 12, Abst. No. 2412. 1962.

The effects of radioactive wastes in the near-shore area, continental shelf and deep sea are discussed with reference to the uptake, retention and dispersion of radioactive isotopes by marine organisms. The evaluation of permissible concentrations of radioactive material in the marine environment, based on current knowledge of the factors involved, is outlined.

5829. Nickerson, H. D. 1961. GLOUCESTER--FORCED CIRCULATION OF BABSON RESERVOIR. *Sanitalk*, 9, No. 3, 1-10 and 27; *Water Pollution Abstracts*, Vol. 36, No. 1, Abst. No. 54. 1963.

The author discusses some results of a study to investigate the effects of forced circulation by aeration of Babson Reservoir, Gloucester, Mass. Aeration was begun in September 1960 and results show that by the end of that month the reservoir had become, and remained, unstratified. No turn-overs have been observed during the study. Aerobic conditions have been attained at the bottom of the reservoir and the number of micro-organisms has greatly increased. Further studies are being undertaken to determine the effectiveness of aeration in reducing color.

5830. Anderson, J. B. 1961. EVALUATION OF STREAMS BY BIOLOGICAL STUDIES. *Proc. 16th Industr. Waste Conf., Purdue Univ. Engng. Extn.* Ser. No. 109, 1-7; *Water Pollution Abstracts*, Vol. 36, No. 1, Abst. No. 163. 1963.

In discussing the use of bottom fauna for indicating the condition of streams, the author

summarizes data obtained from 2 different types of streams, both receiving polluting discharges. In a shallow rapid-flowing stream with rocky bottom the predominant bottom organisms were mayflies, stoneflies and caddisflies, and quantitative differences could be observed between the different stations sampled. In a deep slow-flowing river with steep banks and muddy bottom, the predominant bottom organisms were true flies, worms, snails, and crustaceans, but the populations were variable and it was difficult to interpret the data, although increased populations of worms, snails and midges were observed in areas of organic enrichment.

5831. Alabaster, J. S., and A. L. Downing. 1958. THE BEHAVIOR OF ROACH (RUTILIS RUTILIS L.) IN TEMPERATURE GRADIENTS IN A LARGE OUT-DOOR TANK. Proc. Indo-Pacif. Fish. Coun., 3, 49-71; Water Pollution Abstracts, Vol. 36, No. 1, Abst. No. 164. 1963.

In connection with studies on the effect on fish of heated effluents from electricity generating stations, an apparatus was designed, and is described and illustrated, to permit the use of larger fish than those previously studied, and also make it possible to use both very shallow and steep gradients of temperature and to cause rapid changes in the distribution of temperature similar to those caused by generating stations which operate only for peak-load periods. A report is given of experiments without fish in the apparatus, showing the satisfactory performance of the apparatus for the required purposes. Experiments are also reported using roach as the test fish. It appears that, given a wide enough choice of temperature, roach will eventually select a temperature of about 23°-24° C over a period of one or two weeks, although shoals of fish are occasionally found at temperatures as high as 27° C. When the temperature conditions

change fairly quickly, the apparent selection of temperature is not necessarily affected by the direction of the current or the position of the fish in the tank; under certain conditions the fish selecting warm water can be made to move downstream to remain in it. The size of the fish appeared to have no marked effect on their reaction to longitudinal temperature gradients.

5832. Hoak, R. D., and H. C. Bramer. 1961. DIURNAL VARIATION OF DISSOLVED OXYGEN IN NATURAL STREAMS. Proc. 16th Industr. Waste Conf., Purdue Univ. Engng. Extn. Ser. No. 109, 167-175; Water Pollution Abstracts, Vol. 36, No. 1, Abst. No. 171. 1963.

To obtain actual data on concentrations of dissolved oxygen in streams in western Pennsylvania, a series of surveys was carried out on the Monongahela, Allegheny, Clarion, Ohio and Beaver Rivers and Peters and Little Beaver Creeks, some of which are polluted and some are regarded as clean; results are summarized in tables and graphs. It was found that the concentrations of dissolved oxygen were consistently higher than might have been expected in the presence of moderate to heavy organic pollution, and even at night relatively high values were recorded. There was no simple pattern of diurnal variation, but the lowest concentrations tended to occur at night. The concentrations of oxygen recorded were as high during hot weather (in August) as in cold weather (in March). The authors suggest that it should not be assumed that dissolved-oxygen concentrations will necessarily fall to low values at night, where there is substantial organic pollution, but stress the need for collecting more data at night when assessing the condition of streams. The data obtained also suggest that increased water temperatures due to heated discharges may not necessarily have an adverse effect on dissolved-oxygen concentration.

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